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CORBETT (G. H.). **The Association of the Pyralid Moth, *Tirathaba leucotephras* Meyr., with the Fruit Bunches of the Nipah Palm, (*Nipa fruticans*).**—*Malay. agric. J.* **23** no. 4 pp. 175–178. Kuala Lumpur, April 1935.

Observations showed that neither the Pyralid, *Tirathaba leucotephras*, Meyr., nor the weevil, *Diocalandra frumenti*, F., was responsible for the formation of a gelatinous exudation at the base of female inflorescences of the nipah palm, *Nipa fruticans*, which apparently caused the death of many heads in an area in Malaya during 1934. Nevertheless, both were associated with it to some extent, presumably being attracted by the exudation, and possibly stimulated the flow. Slight exudation occurs at the base of most female heads. Any slight injury caused to the female inflorescence during the removal of the male flowers for the control of the Anthomyiid, *Phaonia corbetti*, Mall. [*cf. R.A.E.*, A **19** 295] neither increases the exudation nor prevents the development of the female head.

UICHANCO (L. B.). **Tolerance of Mealy Bugs to drying up of Host Tissue.**—*Philipp. Agric.* **23** no. 10 pp. 886–890, 2 figs., 2 refs. Los Baños, March 1935.

A root of yam that had been almost completely covered with *Pseudococcus lilacinus*, Ckll., was observed after a year in the laboratory (from January 1931 to January 1932) to be still infested with numerous young nymphs and living adults, although it was wrinkled and nearly dried up. Between 11th and 14th February a piece of fresh material became infested by young nymphs from a bit of the old root placed near it. These nymphs developed into adults, most of which contained ovisacs by 29th March and produced young nymphs. *Trionymus sacchari*, Ckll., survived 49 days (given as 29 days in the table) on stem pieces of sugar cut every 7 or 14 days between February 1932 and February 1933 and stored on a cement floor. Since the life-cycle of the female occupies an average of 39·21 days in the Philippines [*cf. R.A.E.*, A **20** 720], it is not probable that more than one brood can develop when, as in the experiments, the food-plant is prevented from germinating. In the field, however, germination usually begins within a month, and should any delay occur there are 49 days in which the Coccids can live and produce young that can migrate to more favourable food-plants.

In view of this resistance of certain Coccids to adverse conditions, greater care will be necessary in the preparation of fields for planting. It is suggested that their ability to survive on dry plant tissue may account for the occurrence of many introduced Coccids in the Philippines.

SERRÅNO (F. B.). **Pineapple Mealy-Bug Wilt in the Philippines.**—*Philipp. J. Sci.* **55** no. 4 pp. 363–377, 5 pls., 9 refs. Manila, December 1934. [Recd. May 1935.]

After the rapid spread since 1927 of pineapple wilt in the Philippine Islands wherever the Smooth Cayenne variety is grown, field observations and experiments on the relation to it of the mealybug, *Pseudococcus brevipes*, Ckll., confirmed the findings of W. Carter [*R.A.E.*, A **21** 64]. The symptoms of the quick and slow types of wilt are described in detail. Wilting pineapples were more or less heavily infested with the mealybugs, but apparently healthy plants were practically free.

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When pineapple plants were artificially infested, typical symptoms were produced in from 2½ to 12 months, according to the number of mealybugs on the plant. The abundance and general good condition of the colonies seem to be greatly favoured by the attendance of the ants, *Pheidole megacephala*, F., and *Solenopsis geminata* var. *rufa*, Jerd. [*cf.* **19** 676].

Special experiments have shown that the green spotting of the leaves, which is not an important characteristic of wilt but is very common in cases of the quick form, is caused by the feeding of the grey strain of the mealybug, and that the ability to produce the spots is hereditary [*cf.* **23** 166, etc.]. The pink strain of the insect produces chlorotic spots that are characteristic of the two types of wilt, but are commonly associated with the slow form. Both the grey and the pink mealybugs produce young of identical pinkish colour, but on approaching maturity certain individuals turn grey and apparently acquire the ability to produce a secretion, the toxic effect of which on the plant results in green spotting. It has been found that the grey strain establishes larger colonies in a shorter time and feeds over a greater area of leaf than the pink.

Plants affected by quick wilt recovered and produced healthy good-sized fruits if they were pulled up and, before being replanted, were trimmed, cured in the sun for a period of from 5 to 30 days, and dipped in a 1 per cent. hot soap solution (45°C. [113°F.]) for mealybug control. The longer the duration of the curing process, the greater is the chance of recovery of the plant from wilt, as the mealybugs abandon it from want of shelter and suitable food. Most of the plants treated in this way, but not soaked in soapsuds, continued to wilt. Those infected with the slow type of wilt do not seem to be able to recover.

DE JONG (J. K.). *Helopeltis* **in cacaotuinen.** [*Helopeltis* in Cacao Plantations.]—*Bergcultures* **8** no. 28 pp. 658–667. Batavia, 1934. [Recd. May 1935.]

In experiments in the Netherlands Indies, *Helopeltis antonii*, Sign., laid on an average 18 eggs on a tea leaf poor in sugar, 82 on one rich in sugar, and 183 on an average leaf. The corresponding figures for *H. theivora*, Waterh., were 22, 40 and 68. As ordinary tea leaves were punctured 1·4 times as often as those rich in sugar, it is assumed that the same total amount of sugar was obtained from either, but since the total egg-production depends on the proportion of albumens to sugar in the plant-juices, females feeding on leaves rich in sugar laid less eggs.

In cacao plantations the black ant, *Dolichoderus bituberculatus*, Mayr, and *Pseudococcus lilacinus*, Ckll. (*crotonis*, Green) are found as well as *Helopeltis*. It is suggested that as the Coccid excretes much of the sugar it ingests, it needs food richer in sugar than *Helopeltis* does. The author supports this theory by evidence from other experiments in which *Toxoptera aurantii*, Boy., produced most progeny on leaves rich in sugar. If this is so, leaves rich in sugar would be likely to carry a large population of *P. lilacinus* and consequently of *D. bituberculatus*. It is well known that *Helopeltis* is scarce in plantations infested by the ant. It is therefore concluded that cacao resists *Helopeltis* in the measure that it favours the Coccid and consequently the ant. If this is correct, the introduction of the ant as a means of driving out *Helopeltis* [*R.A.E.*, A **5** 572] is obviously useless, but

a decrease in the number of ants on cacao indicates that the plants are likely to be badly infested by *Helopeltis*. The density of the populations of the ants can therefore be used as an index of the effect of cultural measures on cacao.

DE JONG (J. K.). **De Voedselopname van** *Helopeltis*. [The Manner of Feeding of *Helopeltis*.]—*Bergcultures* **9** no. 13 pp. 292–294. Batavia, 1935.

Cohen Stuart's investigations on the punctures made by *Helopeltis* [*R.A.E.*, A **11** 214] have been confirmed. They are supplemented here by further observations in the Netherlands Indies on the way in which the larvae of *H. theivora*, Waterh., puncture and feed on the leaves of tea. The larger the amount of carbohydrates in the leaf the smaller is the discoloured area.

DE JONG (J. K.). **Enkele resultaten betreffende de gehouden enquête over** *Helopeltis* **en Redrust.** [A few Results relating to the Questionnaire on *Helopeltis* and Red Rust.]—*Bergcultures* **9** no. 14 pp. 318–327. Batavia, 1935.

Replies to an enquiry circulated among tea planters in the Netherlands Indies on the Capsid, *Helopeltis*, and red rust are discussed. In some replies red rust was said to follow infestation by *Helopeltis*, but in view of a number of others it is concluded that infestation by the insect and by the fungus run parallel, since good drainage, shelter against wind and pruning off sickly branches, practices used to control red rust, also make the plant less susceptible to attack by *Helopeltis*. Susceptibility rises as the proportion of carbohydrates in the tea plant falls, or in other words, as the relative quantity of albumens increases. It is suggested that wet weather may favour *Helopeltis*, because it may so affect the plant as to cause it in turn to influence the bug's capacity for reproduction. It seems that *Helopeltis* increases under shade where the ground is already rich in organic material and shelter against wind plays no part, but decreases if the shade trees enrich a poor soil and shelter the tea against wind.

KANGAS (E.). **Ueber entomologische Analysen und ihre Anwendung.** [Methods of entomological Analysis and their Application.]—*Acta for. fenn.* **40** reprint 28 pp., 8 graphs., 2 pp. refs. Helsinki, 1934. [Recd. May 1935.]

Methods of entomological analysis of forest trees infested by Coleoptera are discussed. In general the summary method of Trägårdh [*R.A.E.*, A **15** 271] suffices, but sometimes the more exact method of Golovyanko [**14** 208] is necessary. The author has used the latter in Finland, gives examples of its application there and discusses its defects, which are due largely to insufficient knowledge of the biology of the beetles concerned.

KANGAS (E.). **Tutkimuksia Punkaharjun männiköiden hyönteistuhoista.** [Investigations on Injury to Pine Stands by Insects in Punkaharju.]—*Metsät. Tutkimus. Julk.* **19** no. 7 reprint 68 pp., 16 figs., 2 pp. refs. Helsinki, 1934. (With a Summary in German.) [Recd. May 1935.]

These investigations were made in South Finland, in January, May and September 1933. Slightly modified forms of the methods of entomological analysis of trees devised by Golovyanko and by Trägårdh [*cf.* preceding paper] were used.

Myelophilus (*Blastophagus*) *piniperda*, L., and *M.* (*B.*) *minor*, Htg., were responsible for severe damage to the crowns of pines. The adults fed on the shoots, and bored galleries in the trunks for reproduction and hibernation. *Pissodes pini*, L., and *P. piniphilus*, Hbst., which caused far less direct injury, attacked pine in the parts with the thinnest bark, the shoots and thin branches. Larval mines of *Pogonochaerus fasciculatus*, DeG., were found in the tops of the trees where they were withered as a result of the feeding of *M. piniperda* and *M. minor*. The various types of withering caused by the different species are described in detail. *P. pini*, *P. piniphilus* and *Ips acuminatus*, Gyll., were usually primary pests. It was only rarely that initial injury was due to *M. piniperda* and *M. minor*. The feeding of these two beetles on the shoots sometimes destroyed half the needles, but in the area investigated no withering of the pines as a direct consequence was observed, though it occurred in pine stands elsewhere. Infestation of the trunk by the two species of *Myelophilus* sometimes killed the tree, but generally pines appear to be well able to withstand them.

The fuel stacks of fresh pine wood, which are renewed annually, were definitely responsible for the infestations. The beetles found in them were, in order of decreasing abundance, *M. minor*, *M. piniperda*, *Acanthocinus aedilis*, L., *I. acuminatus*, *P. pini* and other species of *Pissodes*, and *I.* (*Pityogenes*) *quadridens*, Htg. *Hylastes* (*Hylurgops*) *palliatus*, Gyll., *Xyloterus lineatus*, Ol., *Pytho depressus*, L., and *Sirex* spp. were present in small numbers. There was only a small amount of débris from fellings, but *M. minor*, *I. acuminatus* and *P. quadridens* bred in it. *M. piniperda*, *P. pini* and some Longicorns were found in stumps, which are not important breeding places except perhaps for *M. piniperda*. *P. piniphilus* was the only species that bred chiefly in withered pines, in which *I. acuminatus* and perhaps also *P. pini* were the only other beetles of any importance. It appeared that *M. piniperda*, *M. minor* and *I. acuminatus* were able to breed in the most varied material, although *M. minor* did not do so very successfully in the thin branches, and *I. acuminatus* was most common in whole trunks. *P. quadridens* preferred thin branches.

Hypophloeus longulus, Gyll., was the most important of the natural enemies of *I. acuminatus*, and it was also found in the mines of *P. quadridens*, *X. lineatus*, *M. piniperda* and *M. minor*, where it destroyed all stages. The Clerids, *Thanasimus formicarius*, L., and *T. rufipes*, Brahms, destroyed the larvae of *I. acuminatus* in their mines and the adults on the surface of the trunks. They also attacked *M. piniperda* and *M. minor*, and the larvae of *T. rufipes* killed those of *P. piniphilus*.

The most important measure would be the removal of all stacks of fresh pine wood. Other subsequent measures would include the removal of all unbarked pine wood and weakened trees, and stripping the bark from stumps. Trees should be felled when the beetles are in the larval stage and barked immediately.

KABURAKI (T.). **Effect of some Exotic Plants and Animals upon the Flora and Fauna of Japan.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **1** pp. 801–805, 3 refs., 1 diagr. Toronto, 1934. [Recd. May 1935.]

Of the insects that have been introduced into Japan, *Cydia* (*Grapholitha*) [*molesta*, Busck], which probably came from China, is now distributed throughout areas where apple, pear or peach are grown. *Bruchus*

rufimanus, Boh. [*cf. R.A.E.*, A **21** 382, etc.], which appeared about 1920, and *B. pisorum*, L., which came from the United States about 1900, are of economic importance on beans and peas, respectively. *Ischnodemus* sp. was observed on sugar-cane in Formosa many years ago and now causes considerable damage in the Loochoo Islands. An Aleurodid [*Aleurocanthus spiniferus*, Quaint.] that is indigenous to southern China is now distributed on *Citrus* over Kyushu and Shizuoka and is attacked by *Prospaltella smithi*, Silv. [*cf.* **20** 495], *P. nipponica*, Silv., *Amitus hesperidum*, Silv., and a Coccinellid. *Eriosoma lanigerum*, Hsm., was observed on apple plants brought from the United States about 1871 and is now found in all apple growing areas. *Phylloxera vitifolii*, Fitch (*vastatrix*, Planch.) was first discovered on grape-vines from America about 1881, since when it has often been introduced from America and elsewhere and has rapidly spread throughout most of Japan. *Icerya purchasi*, Mask., was discovered on *Citrus* in Formosa in 1905 and Shizuoka in 1911, and *Rodolia* (*Novius*) *cardinalis*, Muls., was introduced from California against it in 1909 and 1911, respectively. *Ceroplastes rubens*, Mask., which first appeared near Nagasaki in 1902 and attacks *Citrus* and various fruit and ornamental trees in the southern part of Japan, is parasitised by *Cheiloneurus ceroplastis*, Ishii, *Microterys speciosus*, Ishii, and *Coccophagus hawaiiensis*, Tunb. *Prontaspis yanonensis*, Kuw., was introduced into Nagasaki from China in 1913 and has spread throughout chief *Citrus* areas, but is partly controlled by natural enemies such as *Scymnus* sp., *Cybocephalus* spp., *Platynaspis nigra*, Wse., and *Chrysopa boninensis*, Okam. *Saissetia oleae*, Bern., was first found on *Citrus* in Kanagawa in 1900 and on olive in Shizuoka in 1905 where it appears to have been eradicated, although it apparently still occurs in the Loochoo Islands. *Aspidiotus perniciosus*, Comst., which was introduced from California, is confined to a small area, where it injures pears. *Lepidosaphes ulmi*, L., which was apparently introduced from both Germany and California into Hokkaido, has spread rapidly on apple. *Rodolia limbata*, Motsch., and *Chrysopa matsumurae*, Akamato, are of value against Coccids.

HOPPING (R.). **The chief Forest Insect Problems of the Pacific Coast of North America.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3385–3386. Toronto, 1934. [Recd. May 1935.]

The author cites instances of the reduction of stands of pines and other conifers by insects, particularly bark-beetles, in British Columbia and the western United States. He considers that it is impossible to maintain reserves of living timber without an organisation to report the beginning of outbreaks and to start control measures promptly.

TRÄGÅRDH (I.). **A new Method of obtaining an accurate Estimate of the Number of Insects infesting Storm-ravaged Forests.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3397–3404, 3 figs., 3 refs. Toronto, 1934. [Recd. May 1935.]

A description is given of a method employed in work already noticed [*R.A.E.*, A **23** 223] to determine the degree of infestation by bark-beetles in storm-felled conifers in Sweden. Strips were examined along each side of lines so drawn through the area concerned as to obtain representative cross-sections embracing all the varying conditions.

MOTE (D. C.) & THOMPSON (B. G.). **Recent Research in Insecticides : Substitutes for Lead Arsenate.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3411–3417. Toronto, 1934. [Recd. May 1935.]

Investigations were undertaken in western Oregon during 1928–32 to discover possible substitutes for lead arsenate against *Cydia* (*Carpocapsa*) *pomonella*, L., on apples and pears and *Diabrotica soror*, Lec., on beans for tinning.

Over the period of 5 years, the average percentage of undamaged apples on plots treated with calcium arsenate (2 or 3 lb. with 1 lb. lime to 100 U.S. gals. water) was 87·06, and that on plots treated with lead arsenate 88·6. The calcium arsenate sprays did not injure the foliage. The other materials tested included nicotine sulphate, pyrethrum extracts, potassium fluoaluminate, sodium fluoaluminate, barium fluosilicate, rotenone, and oil sprays. None was so satisfactory as calcium arsenate. Against *Diabrotica*, pyrethrum extract used as a home-made dust with diatomaceous earth gave the best results. All the beetles were killed when it was applied by aeroplane. Dusts of hydrated lime acted as a repellent, and forced the beetles to congregate in restricted areas, where they were all killed by sprays of pyrethrum extract (1 part in 400 water). Calcium arsenate dusts applied by hand were unsatisfactory, but four days after dusting from an aeroplane none of the beetles remained alive.

FULLAWAY (D. T.) & DOBROSCKY (I. D.). **A new *Thripoctenus* Parasite from the Philippines.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3439–3444, 7 refs. Toronto, 1934. [Recd. May 1935.]

In view of the importance of *Thrips tabaci*, Lind., as a vector of yellow spot disease of pineapple in Hawaii, attempts have been made to introduce a parasite for its control. Attention was first given to *Thripoctenus russelli*, Cwfd. [*R.A.E.*, A **20** 640], which is a parasite of *Hercothrips fasciatus*, Perg., in California [**21** 591], but though it had been recorded as attacking *T. tabaci* experimentally, it did not do so when brought to Hawaii.

Further search was therefore made for parasites in the Philippines during 1931. *T. tabaci* was rare on onions and other crops in the Philippines, but *Taeniothrips longistylus*, Karny, was collected from lima beans and cowpeas (*Vigna sinensis*) and was parasitised by *Thripoctenus vinctus*, Gah. [**21** 101]. Adults of *Taeniothrips* placed in glass jars paired readily and oviposited in artificially defoliated bean stems. The larvae hatched within 7 days and about 3 days later were feeding in large numbers in deep crevices in the stems. The life-cycle lasted 3 weeks or less. Successful parasitism was only obtained with the young larval stages of the thrips over a period occupying about a week in its life. *Thripoctenus vinctus* reproduced parthenogenetically. The interval between oviposition and the first sign of parasitism was 7–9 days, the prepupal period lasted 1–2 days, the pupal period 10–12 and the entire life-cycle 18–23. The voyage from Manila to Honolulu takes 19 days, and attempts to retard the development of the pupae only resulted in their death. The parasites were therefore taken first to Kobe, Japan, where they emerged, and where onion plants infested with *Thrips tabaci* and *Taeniothrips* sp. were exposed to them, but there were no signs of parasitism during

the voyage from Kobe. This may have been due to the destruction of pupae of the parasite by mites, but it is more likely that members of the genus *Thripoctenus* are extremely specific in hosts.

QUAYLE (H. J.). *Citrus* **Insect Problems of the Pacific Region.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3445–3449. Toronto, 1934. [Recd. May 1935.]

A review is given of the insect pests attacking *Citrus* in Japan and the Pacific coasts of Australia and the United States. Particular attention is paid to the conditions in California [*cf. R.A.E.*, A **21** 141] and the work effected there on control by biological means and by fumigation and oil sprays.

SHIRAKI (T.). **Insect Pests of** *Citrus* **Trees in Formosa.** (Abstract.)—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3451–3454. Toronto, 1934. [Recd. May 1935.]

A list is given of 126 insects injurious to oranges in Formosa, of which the most important are *Dacus* (*Chaetodacus*) *dorsalis*, Hend., *Brachytrypes portentosus*, Licht., *Melanauster chinensis*, Forst., and some species of Coccids.

UVAROV (B. P.). **The Locust Problem in the Pacific Countries of Asia.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3455–3458, 3 refs. Toronto, 1934. [Recd. May 1935.]

After briefly surveying the locust problem in the countries of Asia bordering the Pacific, with particular reference to China [*cf. R.A.E.*, A **19** 85], Malaya [*cf.* **3** 467] and the Philippines [*cf.* **20** 498], the author suggests that the creation of favourable breeding places by replacing forests with shifting cultivation is responsible for the recent importance of locusts in these countries. Thorough ecological investigations might lead to cultural methods aiming at the production of crops without preparing breeding grounds. Since the swarms travel considerable distances over the sea, such investigations should be organised on an international basis.

SEAMANS (H. L.). **Entomological Problems of Wheat Growing in Canada.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3473–3481, 3 refs. Toronto, 1934. [Recd. May 1935.]

The methods of cultivating wheat in Canada are discussed, with reference to their effect on insect populations, and notes are given on several injurious species, including cutworms, wireworms, grasshoppers and *Cephus cinctus*, Nort.

LEEFMANS (S.). **Brief Review of Agricultural Entomology in the Netherlands Indies.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3483–3497, 4 refs. Toronto, 1934. [Recd. May 1935.]

The author reviews the problems caused by insect pests in the Netherlands Indies, records the principal pests of native crops, forests and estates managed by Europeans, gives an outline of the general control measures customary for each type of cultivation, and summarises the results of work by himself and others. The financial loss

caused by some outbreaks is estimated, and the organisation of research on economic entomology is briefly outlined. The paper concludes with a list of compilations on insect pests and of periodicals that publish articles on economic entomology in the Netherlands Indies.

KUWANA (I.) & KAMITO (A.). **On Legislative Measures for combating Agricultural Pests in Japan.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3515–3520. Toronto, 1934. [Recd. May 1935.]

A general review is given of the administrative measures undertaken in Japan for the control of injurious insects by the Imperial Government, by local governments and by other public bodies, together with a list of 45 of the more important crop pests against which such measures have been employed. The plant quarantine service [*cf. R.A.E.*, A **15** 131] and the institutions engaged in research or in giving instruction in economic entomology in Japan are briefly noticed.

CLAUSEN (C. P.). **Some general Considerations in Parasite Introductions.** —*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3525–3529, 1 ref. Toronto, 1934. [Recd. May 1935.]

This is a general discussion of the work involved in the biological control of an insect pest by means of introduced parasites.

TILLYARD (R. J.). **The Entomological Control of Noxious Weeds in the Pacific Region.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3547–3557, 6 refs. Toronto, 1934. [Recd. May 1935.]

An account is given of work accomplished on the use of insects for the biological control of noxious plants since 1929 [*cf. R.A.E.*, A **18** 464] in Australia, New Zealand, Hawaii, Fiji and New Caledonia. The possibility of employing this method in California is briefly referred to.

MACKIE (D. B.). **Fumigation for Insects.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3559–3565. Toronto, 1934. [Recd. May 1935.]

After summarising the history of fumigation for the control of insect pests, the author reviews investigations undertaken by him on the fumigation of stored products and nursery stock with hydrocyanic acid gas and carbon bisulphide in a vacuum and under industrial conditions at atmospheric pressure.

MCLAINE (L. S.). **Protecting Pacific Countries against Invasion of Insect Pests: Canada.**—*Proc. 5th Pacif. Sci. Congr. Canada 1933* **5** pp. 3567–3571. Toronto, 1934. [Recd. May 1935.]

This is a general discussion of the plant quarantine regulations for preventing the passage of insects and plant diseases into and from Canada.

Jones (E. P.). **Entomological Review, 1933.**—*Publ. Brit. S. Afr. Co.* no. 3 pp. 1–8. London, 1934. [Recd. May 1935.]

In Southern Rhodesia *Citrus* begins to blossom in early August, and the fruit matures and ripens during the following April–September. This period is designated as the crop year, and the proposed series of reports on work at the Mazoe Citrus Experiment Station, of which this is the first, will each deal with a crop year and not a calendar year. Part of the work on the 1933 crop, however, was included in the previous report [*R.A.E.*, A **22** 79]. Data on the various insect pests are given. Several trees from 1 to 2 years old, particularly when they were interplanted in groves with bearing trees, served as foci of infestation by *Aonidiella aurantii*, Mask. The loss in the crop caused by this Coccid is estimated at 1·32 per cent., of which part was due to ineffective fumigation. *Scirtothrips aurantii*, Faure, caused 1·69 per cent. loss, chiefly in groves that could not be sprayed at the proper time owing to the large number of trees to be dealt with, the 10-day interval between the two applications of lime-sulphur, and the prevailing system of irrigation. The reduction of about 38,000 in the number of cases of fruit exported in 1933 as compared with 1932 was chiefly due to the unusually heavy attack of *Heliothis obsoleta*, F. [*cf.* **22** 80]. A more adequate method of control than hand-collection of the eggs and larvae is required.

The development of sooty mould during May–June in connection with *Coccus* (*Lecanium*) *hesperidum*, L., has become increasingly troublesome during the last two years. Though the numbers of the Coccid tend to decrease in the dry period following the end of April [*cf. loc. cit.*], the honey-dew on which the mould grows is still being produced and there is no rain to wash it off. In 1933, however, *C. hesperidum* caused only 0·17 per cent. loss, partly because the rainy season was abnormally short and infested trees were fumigated immediately after the end of the rains instead of being left until June. This practice, which is useful in an outbreak of *C. hesperidum*, cannot be regularly adopted, as an intense infestation of *Aonidiella* might easily develop. A secondary attack of *Aphis tavaresi*, Del Guerc., occurred in January 1933. *Nomadacris septemfasciata*, Serv., was observed for the first time on the Company's estates in December 1932, but caused no damage.

Ford (W. K.). **Some Observations on the Bionomics of the False Codling Moth**—*Argyroploce leucotreta*, **Meyr. (Family Eucosmidae) —in Southern Rhodesia.**—*Publ. Brit. S. Afr. Co.* no. 3 pp. 9–34, 16 refs. London, 1934. [Recd. May 1935.]

A moderately heavy infestation of *Argyroploce leucotreta*, Meyr., occurred on oranges in Southern Rhodesia during February–April 1930. Investigations carried out over 3 years on its bionomics and reaction to climatic conditions and particularly on the plants it attacks, showed that it is unlikely to become a major pest if cultural measures are strictly carried out. Eggs are laid on the surface of the fruit and hatched in 6–8 days in January–April 1932. Two larvae are sometimes found in a guava but only one in a fruit of any of the other food-plants, which include trees and shrubs of several different families. The larval period probably varies according to the climatic conditions,

the species of food-plant and the ripeness of the fruit. The pre-pupal and pupal stages are passed in cocoons in the soil and lasted 10–50 days according to monthly observations in 1931. Six generations a year are possible at Mazoe. Probably never more than 3 per cent. of the oranges are destroyed. Unripe fruits are less susceptible to attack than ripe ones. In an orchard containing navel, mid-season, and Valencia oranges, infestation could be maintained throughout the year. During October–January infestation is at a minimum in the orchards and at a maximum on the veldt, and it seems likely that about mid-October moths from the Valencia groves oviposit on the fruit of such plants as *Pseudolachnostylis maprounaefolia* and *Combretum apiculatum* as well as on young fruit of navel oranges, and that the progeny of these moths will eventually oviposit on ripening oranges from January onwards. *Trichogramma luteum*, Gir., has not been reared at Mazoe, although blackened eggs, a sign of parasitism, have been observed, and it is known to attack *A. leucotreta* on *Citrus* in the Transvaal. A Braconid of the genus *Microdus* has been bred from a larva in orange and from larvae in *Pseudolachnostylis*. The Ichneumonid, *Glypta leucotretae*, Wlkn., is relatively common and attacks the larvae in 7 of the food-plants, including oranges. It oviposits in the host larva, which succeeds in making a cocoon but does not pupate. The pupal stage of the parasite, which is passed within the host cocoon, is prolonged during the winter. Investigations during 1931–32 showed that this Ichneumonid is of some importance in controlling *Argyroploce* at Mazoe, and though the percentage of parasitism is not high, it remains fairly constant. Infested fruit on the trees and fallen fruit should be collected and buried under a foot of earth, and off season fruit should be avoided.

Rivnay (E.). **The Biology of the Greenhouse Thrips *Heliothrips haemorrhoidalis* Bouché in Palestine.**—*Hadar* **7** no. 10–11 reprint 16 pp., 13 figs., 3 graphs, 6 refs. Tel-Aviv, 1934. [Recd. May 1935.]

The bionomics of *Heliothrips haemorrhoidalis*, Bch., were studied for two years in Palestine in the laboratory and in a few places along the coastal plain where *Citrus* is sometimes badly damaged by it [*R.A.E.*, A **22** 552]. All stages are described. It was found that there are about 7 overlapping generations a year. The life-cycle is completed in 30–33 days at 26–28°C. [78·8–82·4°F.], in about 40 days at 23–25°C. [73·4–77°F.], and in about 2 months at 20°C. [68°F.]. During the winter months from November to February, when the temperature falls below 16°C. [60·8°F.], only a single generation is produced and the egg stage alone lasts above 2 months. At 26–28°C. the egg, larval and pupal stages last 14–15, 9–10 and 3 days, respectively, and the pre-oviposition period is 4–5 days. The eggs are inserted singly beneath the epidermis of the leaves and fruit. Under favourable conditions of temperature and food a thrips lays about 50 eggs. Males were neither found nor reared by the author. As the temperature decreases, adults live and reproduce over a longer period, but produce eggs more slowly. During the spring and early summer they feed on the mature leaves alone. As the fruits ripen towards late June, they migrate to them, and usually congregate at points where a fruit and leaf touch.

A rare predacious thrips, *Franklinothrips myrmicaeformis*, Zanon, and in one instance larvae of *Chrysopa* (?) *vulgaris*, Schn., which is common in *Citrus* groves, were observed feeding on *H. haemorrhoidalis*.

SEVERIN (H. H. P.). **Experiments with the Aster-Yellows Virus from several States.**—*Hilgardia* **8** no. 10 pp. 305–325, 4 figs., 21 refs. Berkeley, Calif., October 1934. [Recd. May 1935.]

Recent work on the transmission of the aster yellows virus to various plants by *Cicadula divisa*, Uhl., is briefly reviewed [*cf. R.A.E.*, A **18** 17 ; **19** 580 ; **21** 168]. *C. divisa* has previously been erroneously identified as *C. sexnotata*, Fall., which is a European species. It has been thought that there are two distinct viruses that cause aster yellows, as in California the disease is readily transmitted to celery and zinnias (*Zinnia elegans*), plants that are highly resistant to it in New York.

The following is based on the author's summary : Yellows was transmitted to healthy asters by previously non-infective Jassids from asters naturally infected in New York, Indiana and Wisconsin. Jassids fed on asters or salsify [*Tragopogon porrifolius*] infected in New York transmitted it to 8 of 207 celery plants. They transferred the virus from an experimentally infected celery plant to healthy asters, but not from these back to celery. Six out of 82 celery plants were infected with the yellows disease obtained from Wisconsin and from 2 of the 6 it was transmitted back to asters. Ten celery plants exposed to Jassids that had fed on diseased asters from Indiana failed to develop symptoms of the disease. It was transmitted from celery naturally infected in Utah to aster and celery plants and again from the celery to healthy celery plants. It was readily transmitted to healthy carrots from asters naturally infected in New York, Maine and Wisconsin. Leafhoppers transferred yellows from carrots experimentally infected with the virus from New York to asters but not to celery. They failed to transfer yellows from carrots experimentally infected with the virus obtained from Maine and Wisconsin to asters or celery, but transmitted it readily to healthy carrots from carrots naturally infected in Maine and Idaho. It was also transferred from one carrot naturally infected in Maine to aster and celery, but not from the infected aster or celery to healthy celery. Of 61 celery plants on which Jassids fed after feeding on carrots naturally infected in Idaho, 3 showed symptoms of yellows, but the virus was not recovered from them. Two varieties of parsley and plantain (*Plantago major*) were experimentally infected with yellows by leafhoppers that had been exposed to aster yellows obtained from New York, but the virus was not recovered from them. Parsnip plants were experimentally infected with the aster yellows virus from Indiana and Wisconsin, and the carrot yellows virus from Maine, but the virus was not recovered from them. The number of tests, however, was not sufficient to prove that the virus might not sometimes be recovered. *C. divisa* after feeding on 3 varieties of *Zinnia elegans* naturally infected with yellows in California transmitted it to healthy celery. After feeding on 9 diseased *Zinnia elegans*, previously non-infective examples of *Eutettix tenellus*, Baker, transmitted curly top to healthy sugar beet. Of 25 varieties or hybrids of *Z. elegans* each exposed to 2 lots of 10 infective individuals of *C. divisa*, 2 developed symptoms of yellows, but the virus was not recovered by leafhoppers. When

another 25 varieties or hybrids were experimentally infected with the curly top disease the virus was recovered by *E. tenellus* and transmitted to sugar beets.

Thamnotettix montanus, Van D., a newly discovered vector of California aster and celery yellows, failed to transmit yellows from asters naturally infected with the virus in New York and Wisconsin to healthy asters and celery.

Severin (H. H. P.) & Haasis (F. A.). **Transmission of California Aster-Yellows to Potato by** *Cicadula divisa*.—*Hilgardia* **8** no. 10 pp. 329–335, 4 figs., 2 refs. Berkeley, Calif., October 1934. [Recd. May 1935.]

The following is mainly taken from the authors' summary: Of potato plants inoculated with California aster yellows by infective individuals of *Cicadula divisa*, Uhl., 50 per cent. developed symptoms of the disease, which is characterised by thin purple shoots and aerial tubers growing from the axils of the leaves. The incubation period varied from 20 to 63 days during the four seasons of the year. Asters and celery did not develop the disease when Jassids that had fed on all the infected potato plants were transferred to them, and the virus was not recovered when Jassids were fed on the cut surfaces of potato tubers from infected plants. The disease has not been found in potato under natural conditions, but *C. divisa* has been taken in potato fields.

Severin (H. H. P.). **Transmission of California Aster and Celery-Yellows Virus by three Species of Leafhoppers.**—*Hilgardia* **8** no. 10 pp. 359–361, 1 pl., 2 figs., 23 refs. Berkeley, Calif., October 1934. [Recd. May 1935.]

The following is based on the author's summary: Experiments in California demonstrated that *Thannotettix montanus*, Van D., is a vector of celery yellows under natural conditions and also transmits yellows from aster and other plants. Of the celery plants inoculated by it, 26·1 per cent. developed the disease, and of the asters 2·9 per cent. Other plants experimentally infected by it were carrots, mustard (*Brassica alba*), spinach, lettuce, and plantain (*Plantago major*). Curly top was not transmitted to sugar beets by this leafhopper. *T. geminatus*, Van D., failed to transmit yellows from naturally infected asters, or from asters and celery experimentally infected by *Cicadula divisa*, Uhl., to healthy asters; but further tests are being made. The transmission of yellows from celery to celery by it averaged 13·7 per cent. When tested singly, it transmitted yellows to 2·4 per cent. of the healthy celery plants. It also transmitted yellows from infected to healthy plants of 2 varieties of carrots.

The author concludes that if aster and celery yellows are caused by two viruses, *C. divisa* and *T. montanus* failed to separate them, and apparently only one virus is concerned. *C. divisa* transmitted the virus from naturally infected asters to healthy celery with greater efficiency than *T. montanus*, infecting 48·3 per cent. of the plants as compared with 20 per cent. In one test on the recovery of the virus from experimentally infected celery, *C. divisa* infected 100 per cent. of the aster and celery plants, whereas *T. montanus* did not infect asters but infected 44·4 per cent. of the celery plants.

Boyce (A. M.). **Bionomics of the Walnut Husk Fly,** *Rhagoletis completa.—Hilgardia* **8** no. 11 pp. 363–579, 77 figs., 39 refs. Berkeley, Calif., October 1934. [Recd. May 1935.]

This monograph is based on laboratory and field studies during 1928–32 in California. *Rhagoletis suavis completa*, Cress., a serious pest of the Persian walnut (*Juglans regia*), is raised to specific rank on the evidence of wing markings, male genitalia and biology. Separate sections deal with the taxonomy of the fly, descriptions of all stages, distribution, economic importance, bionomics and control. Some of the information has already been noticed [*R.A.E.*, A **17** 228; **20** 28, 175, 692; **21** 602, etc.]; in the first paper [**17** 228], the fly was recorded as *R. juglandis*, Cress.

R. completa occurs in Nebraska, Kansas, Oklahoma, Texas, New Mexico and California. Infestations of minor importance have been observed on peach in the field. In the laboratory, the females oviposited or attempted to oviposit in many fruits and tubers in addition to walnut and peach, but none permitted complete development. In the field, the adults seem to feed on honeydew resulting from the infestation of walnut trees by *Chromaphis juglandicola*, Kalt., spores of yeast and fungi occurring on the trees, and atmospheric dew. In the laboratory, the adults lived for an average of 40 days and a maximum of 85. Without food, the majority died within 50 hours. High relative humidity is apparently a very important factor in longevity. Except when abundant moisture prevailed, all flies were killed when the temperature remained at 114°F. for two hours. Daily maximum temperatures ranging from 95 to 100°F. shortened their lives considerably. The maximum number of eggs laid by one female in the laboratory was 84, but it is estimated that under optimum field conditions a female may lay 200–400 eggs. The larvae feed gregariously and only consume healthy tissues. In the field, they reached maturity in 36·8 days on an average, though in the early part of the season some completed their development in 18–20 days. Larval mortality within the walnut husk approximated 25 per cent. Limited laboratory studies were made on the effect of temperature on full-grown larvae removed from walnut husks. A temperature of 30°F. for 35 hours caused fairly high mortality, but stimulated pupation of the survivors when they were kept at 72°F., although many soon died in the puparia. An exposure of $\frac{3}{4}$ hour at 115°F. killed all the larvae. Natural enemies include *Pediculoides ventricosus*, Newp., and *Orius* (*Triphleps*) *insidiosus*, Say, which attack the eggs, and *Spalangia rugosicollis*, Ashm., and *Galesus* sp., which have been reared from the pupae. The larval parasites, *Opius humilis*, Silv., and *Diachasma tryoni*, Cam., have been introduced from Hawaii and bred on *R. completa* in the laboratory. Both were liberated in the field in 1931 and 1932 and *Opius* was recovered in 1932.

Entomology.—*Rep. Ala. agric. Exp. Sta.* **44** pp. 27–29. Auburn, Ala. [1934.] [Recd. May 1935.]

In studies by L. L. English on pests of *Citrus* in Alabama *Lepidosaphes beckii*, Newm. (purple scale) completed 7 generations in 2 years, its life-cycle varying from 52 to 148 days. Lime-sulphur (1 : 50) gave good control of scales 2 weeks old or less, but its effect on older scales was more dependent on weather conditions. *Parlatoria pergandei*, Comst. (chaff scale) had 3 generations a year, and the life-cycle ranged

from 57 to 96 days. One application of lime-sulphur followed by 2 applications of oil reduced the injury caused by *Phyllocoptes* (*Eriophyes*) *oleivorus*, Ashm. (rust mite) from 45·6 per cent. on the controls to 0·5–1·7 per cent. on the treated plots.

Studies by J. M. Robinson and F. S. Arant on the control of the boll weevil [*Anthonomus grandis*, Boh.] with calcium arsenate dust were continued in 1932 [*cf. R.A.E.*, A **20** 629, etc.]. Of 10 applications made during the fruiting season 4 were affected by rain within 24 hours. The yields of cotton were slightly above the avérage for the past 6 years, and there was a definite increase on all fertilised plots that had been dusted. The increased yields from dusted cotton were 213, 128, 426 and 400 lb. seed cotton per acre on the plots receiving 500, 1,000, 1,500 and 2,000 lb. fertiliser per acre, respectively.

Tests by J. M. Robinson indicated that calcium arsenate dust (9 lb. per acre) is the most satisfactory insecticide for the control of the turnip webworm [*Hellula undalis*, F.].

F. S. Arant continued life-history studies of *Chalcodermus aeneus*, Boh. (cowpea curculio) [*cf.* **20** 607]. The average number of eggs deposited by a female was 111·1 and the maximum 281. The maximum number deposited in one day was 10 and the average 2·6. The incubation period averaged 3·5 days. Of the immature stages observed 2·5 per cent. were parasitised by a Tachinid, *Myiophasia globosa*, Tns. None of the weevils placed in hibernation cages survived the winter, although there was a 5 per cent. survival in 1931–32. Considerable difference was observed in the susceptibility of varieties of cowpeas. In dusting tests, sodium fluosilicate alone or mixed with colloidal silica or gypsum reduced the infestation and did not injure the foliage. Lead arsenate and barium fluosilicate scorched the foliage rather severely.

Further work on the life-history and control of *Curculio caryae*, Horn (pecan weevil) [*cf.* **20** 608] was done by H. S. Swingle. Pupation took place between 9th September and 11th October. Some of the weevils require 2 or 3 years to complete their life-cycle. In one grove 18,000 weevils were taken by the jarring method, which was the most successful means of control, and over 70 per cent. of the nuts were free from larvae when gathered. *Metarrhizium anisopliae* and *Beauveria* (*Sporotrichium*) *bassiana*, fungi parasitic on the weevil, were reared successfully by H. S. Swingle and J. L. Seal on maize meal. Three applications of spores were made to the soil round pecan trees, but though the fungi apparently became established, the weevil larvae were not satisfactorily controlled.

Bliss (C. I.), Cressman (A. W.) & Broadbent (B. M.). **Productivity of the Camphor Scale and the Biology of its Egg and Crawler Stages.**—*J. agric. Res.* **50** no. 3 pp. 243–266, 10 figs. Washington, D.C., 1st February 1935. [Recd. May 1935.]

The following is substantially the authors' summary of studies of *Pseudaonidia duplex*, Ckll., in Louisiana: The productivity of the females in the laboratory was estimated by counting the newly emerged scales on potted camphor trees [*Cinnamomum camphora*] and Satsuma orange plants, and by removing the covering from females on camphor tree twigs and observing oviposition directly. According to the first method first-brood females produced an average of 125 progeny, and second-brood females 110. Productivity on Satsuma orange was somewhat

higher. According to the second method the females showed a higher total productivity. Between 14 and 29°C. [57·2 and 84·2°F.], the rate of oviposition increased as the temperature rose, but it decreased as the temperature moved above and below these limits. Productivity in the field was determined by counting the eggs found beneath the scales of field-collected adults. The oviposition period ranged from 13 weeks for the overwintered females to 5 or 6 weeks for females of the first and second broods. Eggs from the youngest females had the longest incubation period, but the older females retained their eggs longer after development had started. High temperatures shortened the embryonic period. The crawlers seldom came out from beneath the parent scale between 6 p.m. and 6 a.m. The time of emergence during the day, which was earlier on warmer days, depended partly upon the temperature. When midday temperatures fell below 20°C. [68°F.], few crawlers came out during the day. They were positively phototropic, but orientation toward a light source was not exact. The rate of crawling diminished as the angle of deviation between the direction in which they crawled and the direction of the light increased. The rate was accelerated by high temperatures within the range 17–37°C. [62·6–98·6°F.]. In controlled experiments, the highest percentage of crawlers settled in the temperature range 27–30°C. [80·6–86°F.], but at all temperatures between 22 and 32°C. [71·6 and 89·6°F.] more than 90 per cent. of the crawlers that survived settled in the first 6 hours after being transferred to the twigs. A rise of one degree centigrade in temperature between 15·2 and 29·2°C. [59·36 and 84·56°F.] caused the number of crawlers that settled and formed scales to increase by $3\frac{1}{2}$–4 per cent., representing a survival of from 25 to 75 per cent. Above 29·2°C. there was usually a reduction in the number that settled. Since crawlers often do not emerge from beneath the parent scale at temperatures below 20°C., it is probable that settling in the field would seldom average below 40 per cent. of normal emergence. Besides, crawlers tend to emerge in the early morning on very warm days. When infested plants were exposed intermittently to a maximum air velocity of 12·7 miles per hour, only 37 per cent. of the crawlers transferred to them settled, as compared with 76 per cent. on plants kept in still air. On camphor trees, most of the females settled on the stems round nodes and bases of petioles, and most of the males on the leaves next to the midrib. In either sex, the proportions settling on the leaf and stem were more nearly equal when settling took place in the dark, but the difference was not sufficient to show how sex affects the situation of the insects on the plant.

Cressman (A. W.), Bliss (C. I.), Kessels (L. T.) & Dumestre (J. O.). **Biology of the Camphor Scale and a Method for Predicting the Time of Appearance of Stages in the Field.**—*J. agric. Res.* **50** no. 3 pp. 267–283, 7 figs., 8 refs. Washington, D.C., 1st February 1935. [Recd. May 1935.]

The results of further studies in Louisiana on the biology of *Pseudaonidia duplex*, Ckll., from the time of settling to the beginning of the reproductive period [*cf.* preceding paper] are here taken from the authors' summary. The rate of development depended mainly on the mean temperature, and the indices of correlation between duration and temperature were 0·98 for the first stage and 0·96 for the second. The

first and second stages, the time from the second moult to egg production, and from the first egg to appearance of the newly settled nymphs are shown in graphs as functions of temperature. Of the females that settled on the stems of camphor plants [*Cinnamomum camphora*], 88·9 per cent. completed the first stage, 56·4 the second, and 33·4 reproduced. About equal numbers of males and females were produced, and fertilisation was necessary for reproduction. The mean temperature from the date of emergence of the first brood was found to be a satisfactory basis for predicting the time of appearance of the different stages under field conditions, since the calculated and observed dates for field counts extending over 3 years agreed within the accuracy of the data. From 30 to 37 per cent. of the scales were killed by low winter temperatures. Resistance to temperatures below freezing point was greatest when they were preceded by subnormal temperatures and when the scales were in the earlier stages of development. Parasites and predators are not important in the control of this insect.

Phillips (W. J.) & Dicke (F. F.). **Morphology and Biology of the Wheat Joint-worm Gall.**—*J. agric. Res.* **50** no. 4 pp. 359–386, 13 figs., 13 refs. Washington, D.C., 15th February 1935. [Recd. May 1935.]

The following is based on the authors' summary: A study of the development of galls in wheat stems following attack by *Harmolita tritici*, Fitch, indicates that its absence from Kansas and western Missouri is due to the character of the stems. As it is difficult for the ovipositor to pierce the leaf sheath and stem of the wheat plant, the female usually oviposits only in the delicate tissue in the meristematic region just above the node. The larvae do not survive when the eggs are placed in older and tougher tissue. As many as 5–6 eggs may be deposited through a single external oviposition puncture, and 3 such punctures may be made at the same node in practically the same horizontal plane. Eggs are placed only in or near the phloem of the vascular bundle. This habit appears to be specific to this insect. About 80°F. is the optimum for oviposition. Under the most favourable conditions, the females deposit the majority of their eggs and die within about 2 days of emergence.

In samples of wheat grown in Kansas, the meristematic region at the node was found to be too tough and hard to be suitable for oviposition. It is probable that if oviposition did occur, the cells would not respond to the stimuli essential for the development of the normal gall tissue necessary for the nourishment of the larvae. This explains why the pest does not occur in the Kansas wheat belt and, perhaps, in certain parts of central Missouri.

Eggs that have not hatched remain as inert foreign substances embedded in the tissue. This indicates that the female does not inject a substance to initiate the production of the gall tissue. Hyperplasia and hypertrophy start at once upon hatching of the eggs, and cell multiplication is by mitosis only. Hyperplasia ceases after the first instar, and is succeeded by hypertrophy. Gall tissue arises partly from the phloem but mainly from the parenchyma, and the cells in the gall area lose their normal polarity. There is no pith cavity in the part of the internode within the gall area, this section of the internode being filled with gall cells. The destruction of nearly

all the vascular tissue in this region greatly interferes with the normal functions of the plant. There are no concentric layers or zones in the gall tissue as is common in Cynipid galls. The entire region lignifies and becomes hard by the time the larvae are fully grown. The gall stimulus is apparently due to by-products of larval metabolism and perhaps to mechanical irritation.

It should be possible so to accelerate the growth of wheat in the early spring, by manuring or otherwise, that the plants would be unacceptable for oviposition or unsuitable for larval development at the time of attack. Even if this measure did not prevent infestation, the additional growth of the plants would result in the galls being so high up on the culms that they would be removed by the reaper at harvest, and infestation in the following crop would be consequently reduced.

Ries (D. T.). **Biological Study of the Walnut Husk Fly** (*Rhagoletis suavis* **Loew**).—*Pap. Mich. Acad. Sci.* **20** pp. 717–723, 3 pls., 4 refs. New York, 1935.

This study of *Rhagoletis suavis*, Lw. (walnut husk fly) was carried out in Michigan, where it has only been found on black walnut (*Juglans nigra*), which is not of commercial importance, and to a less extent on butternut (*J. cinerea*), though in other States it has been reared from Persian and Japanese walnuts (*J. regia* and *J. sieboldiana*). The feeding of the larvae causes the excocarp to turn black and the tissues to break down. The dates on which the adults emerged depended largely on the temperature in the ground during the pupal period. The dates of the first oviposition (23rd August in 1932 and 22nd August in 1933) varied neither with the dates of emergence (20th July–26th September in 1932 and 19th June–24th September in 1933) nor with the peaks (early August in 1932 and late June in 1933), probably because oviposition cannot take place until the exocarp of the nut becomes soft enough for the insertion of the ovipositor. The flies fed freely on sugar water in cages and behaved normally, but several types of bait failed to attract them in the field. The various stages and the processes of pairing and oviposition are described. The number of eggs found in a single puncture varies from 10 to above 150 according to number of females that have visited it. The egg stage lasts 8–10 days and the larval 35–40. The larvae usually leave the husks 3 or 4 days after the nuts fall. They burrow 4–7 inches below the surface of the soil and pupate within 2–4 days. Only a few larvae pupate in the husk. Nuts that were collected on 2nd October contained first instar larvae, but it was not determined if active larvae found in the husks at the end of November were able to survive the winter. On 22nd September females were still ovipositing in the husks. About 6·8 per cent. of the pupae kept in cages during the winter of 1931–32 did not produce adults in 1932, but 4·3 per cent. of these did so in July 1933.

[**Papers on the Codling Moth.**]—*Trans. Ill. hort. Soc. 1934* **68** 508 pp., 20 figs., 2 refs. Springfield, Ill., 1935.

W. P. Flint, S. C. Chandler, E. R. McGovran and M. D. Farrar, in " Progress in Control of Codling Moth in 1934 " (pp. 153–176), record that in general infestation by the codling moth [*Cydia pomonella*, L.] was lower in 1934 than in the two previous seasons in Illinois.

The average infestation was 8·8 per cent. in all orchards when lead arsenate (3 lb. to 100 U.S. gals.) was used with oil (3 or 4 U.S. qts.) and 21·2 per cent. when it was used with lime (6 lb.), and it now appears almost impossible to secure a satisfactory control with lead arsenate without the use of oil or some effective spreader, sticker or ovicide. Summer oils gave better results than miscible oils, although even with these the control was twice as good as that obtained with lead arsenate and lime alone. Soybean oil resulted in severe injury, probably owing to the condition of the trees and to the high temperatures. A commercial brand of cuprous cyanide, Kutane (4 lb. per 100 U.S. gals.), gave almost as good control as the best combination of summer oil and lead arsenate, but it caused severe injury to the foliage and a premature drop of the fruit. A commercial brand of manganese arsenate, Manganar (used at the rate of 4 lb. with 100 U.S. gals. Bordeaux mixture and 2 U.S. qts. miscible oil), gave slightly better control than a mixture of lead arsenate, lime and summer oil. The addition of ½ lb. tar soap increased the effectiveness of a spray of 3 lb. lead arsenate, 6 lb. lime and 3 U.S. qts. summer oil, which gave as good results as one of 3 lb. lead arsenate, 3 U.S. qts. summer oil and ½ lb. spreader, although it resulted in a heavy lead residue. Good control was obtained with 4 lb. of a commercial brand of cryolite, Kalo, together with ¾ per cent. summer oil. In tests of materials in which to dip crates for the destruction of the hibernating larvae, only 1·8 per cent. of the moths emerged from those dipped for 3 minutes in kerosene.

G. M. List, in "Codling Moth Control in Colorado" (pp 177–190), gives a general outline of the situation in this State [*cf. R.A.E.*, A **22** 599], with reference to the importance of thorough application of sprays and to the residue problem, and records investigations undertaken by J. H. Newton on the effect of various sprays on two varieties of apples in one orchard.

W. A. Ruth and K. K. Jadow discuss tests begun in Illinois in "Spray Residue Removal" (pp. 101–198). Apples sprayed with lime, lead arsenate and oil can be washed successfully in dilute hydrochloric acid, but if lime is omitted from the schedule a tandem wash of sodium silicate and hydrochloric acid, respectively, will often be necessary. Preliminary dry brushing is valueless. It is particularly important to avoid the accumulation of heavy residue on the varieties most sensitive to acid.

W. P. Flint, in "Codling Moth Control in southern Illinois in 1934" (pp. 460–468) states that the reduction in average infestation was principally due to the use of oil in the lead arsenate sprays. Not more than 3 or 4 applications of oil should be made during the summer and in general oil should not be used with lead arsenate after 15th August. Only tested oil emulsions should be used and the rate should not exceed ¾–1 per cent.

JEWETT (H. H.). **The Clover Root Curculio.**—*Circ. Kentucky agric. Exp. Sta.* no. 42 pp. 15–23, 3 figs., 4 refs. Lexington, Ky, April 1934. [Recd. June 1935.]

Notes are given on the bionomics of *Sitona hispidula*, F., and the injury it causes [*cf. R.A.E.*, A **18** 478; **22** 643]. Experiments in Kentucky suggest that although it was not numerous enough on lucerne and clover during 1932 and 1933 to cause much damage, it might be very injurious if its population became large. The adults affect the

growth of the seedlings, particularly of the young ones. There was little difference in the reduction in yield of plants from seed sown in spring or autumn. The yield of lucerne, which was more damaged than clover, was reduced by as much as 18·6 per cent. after two years' infestation.

DUSTAN (G. G.). **The Effects of the Cold Winter of 1933–34 on the Oriental Fruit Moth.**—*Canad. Ent.* **67** no. 4 pp. 65–68. Orillia, April 1935.

Investigations were undertaken to determine the effect on the oriental fruit moth [*Cydia molesta*, Busck] of the winter of 1933–34, which was the coldest in the Niagara Peninsula since its discovery there in 1925 [*cf. R.A.E.*, A **15** 34]. In this region the winters are usually comparatively mild, and during the whole period 1925–33 the temperature at Vineland Station fell below 0°F. on only 4 days, the minimum being −7°. In 1933–34 it fell to −14° and was below zero on 12 days. The percentage mortalities among hibernating larvae placed in the field on soil débris and peach stumps were 91·4 and 98·4 in this winter as compared with 95 and 93·9 in the preceding one. There was little if any reduction in the numbers of moths of the overwintered brood in 1934, and the first generation was probably larger since the injury to the twigs averaged 10·2 per cent. as compared with 9·2 in 1933. The weather caused a reduction in the peach crop, and it was feared that after the hardening of the twigs the newly emerged moths might migrate to apple orchards. Most of them, however, seemed to oviposit in the peach orchards where few twigs would be succulent enough for the resulting larvae to mature. A reduction in the moth population is therefore anticipated in 1935 in the orchards that had no crop.

MATHERS (W. G.). **Some Meteorological Observations in Relation to the Spruce Budworm.**—*Proc. ent. Soc. B.C.* no. 31 pp. 22–27, 1 graph. Victoria, B.C. [1935.]

Field studies of *Tortrix* (*Cacoecia*) *fumiferana*, Clem., were conducted during 1927–32 in British Columbia, where several outbreaks had occurred. It infested Douglas fir [*Pseudotsuga taxifolia*] and balsam fir [*Abies balsamea*] growing at sea level in Vancouver Island where it is active from May–July at an average temperature of 56–60°F. with a rainfall of 2–3·5 ins., and alpine fir [*A. lasiocarpa*] and Engelmann spruce [*Picea engelmanni*] at altitudes of 3,000–4,500 ft. in the Barkerville area on the mainland, where it is active from July to August at a temperature of 52°F. with a rainfall of 10 ins. In the latter place, where it takes two years to complete its life-cycle instead of one as in the Island, a fact that accounts for the persistence of infestation, the larvae emerged about mid-June, returned to hibernation after developing to the third or fourth instar, emerged again in June of the following year, and completed development. The eggs were laid in August. Fairly extensive meteorological observations in both areas are quoted in order to show the effect of meteorological conditions on the dates of hibernation and emergence and the rate of feeding and development. According to data obtained in 1932 by rearing individually 83 examples from the mainland, the mean temperatures were 53·7 and 47·3°F. for pupal periods of 16 and 33–35 days, and 54 and 51·7°F. for incubation periods of 17 and 26 days, respectively. On Vancouver

Island in 1928 the incubation period varied from 9 to 15 days as the average temperature varied from 69 to 62°F.

An attempt was made to determine the total amount of effective temperature, expressed in day-degrees, necessary for the pupal and egg stages. The threshold of development was taken as 42°F. In the Barkerville area the total varied from 178 to 214 day-degrees F. for the pupal stage and from 206 to 264 for the egg stage. On the Island the corresponding figures were 272–311 and 227–359. The average mean temperature for a pupal period of 17 days in Vancouver Island was 60·3°F. and the number of day-degrees 311, while in the Barkerville district the mean temperature was 54° and the number of day-degrees 187 for a pupal period of 16 days. The variations are probably due mainly to the climatic factors, although difference in the trees attacked and possibly in strains of the moth may have some effect.

HERIOT (A. D.). **Notes on the Blister made by *Eriophyes pyri* Nal.**—*Proc. ent. Soc. B.C.* no. 31 pp. 41–42. Victoria, B.C. [1935.]

The manner in which *Eriophyes pyri*, Nal., causes blisters on the leaves of pear is discussed. It is concluded that the mite incites enlargement of the loose mesophyll cells, which expel air from between them, and that the air presssure produced closes the stomata, raises the epidermis from the underlying tissue and subsequently causes it to rupture at a stoma, the air pressure in this case taking the place of the complimentary tissue that breaks through the epidermis to form a lenticel.

TUCKER (R. W. E.). **The Control of *Diatraea saccharalis* in Sugar Cane in Barbados by frequent Liberation of mass reared *Trichogramma*. A Review of Data obtained from 1929–34.**—*Agric. J. Barbados* **4** no. 1 pp. 25–50, 1 fig., 1 map, 7 fldg graphs, 16 refs. Barbados, January 1935. [Recd. June 1935.]

This critical discussion on the biological control of *Diatraea saccharalis*, F., in Barbados [*cf. R.A.E.*, A **23** 240, etc.] is divided into two parts. In the first the author outlines the chief factors in the situation in sugar-cane fields when the parasite, *Trichogramma minutum*, Riley, is not periodically liberated. In the second, he tries to show how the annual liberation of large numbers of artificially reared parasites modifies the natural balance existing between *Diatraea* and the total mortality caused by parasites, predators and other factors, and to determine to what extent it diminishes the accumulated damage to the crop.

During 1929–34, the average field parasitism of the eggs of *Diatraea* increased with the rise in the annual production and liberation of *Trichogramma*. Each year a reduction occurred in the average field loss in cane rendered valueless by the borer and in the factory loss as shown by the percentage of damaged cane joints. The purity of the juice increased and the total tonnage of sugar rose. From a discussion of the benefit resulting from annual liberations, the author concludes that if masses of the parasite are liberated from March to September the damage caused by *Diatraea* is proportionately decreased and will not become economically important even though the borer population again increases after the liberations have ceased. He thinks that damage at other times is unimportant compared with that done during March–September, since the development and growth of the cane during

this period coincides with the most rapid increase of *Diatraea*. Infestation of new crops, which has its main source in adjacent fields of old crops, is small at first, and any attempt to reduce it would not be likely to produce a greater alteration than that caused by fluctuations in climatic factors. Colonisation of *Trichogramma* is quite practicable on account of the ease, cheapness and economic effectiveness of routine mass-rearing.

Appendices contain records of the temperature and humidity in a cane field and notes on early larval mortality of *Diatraea*.

TUCKER (R. W. E.). **Report on Visit to Antigua May 24th–June 20th 1934 to obtain** *Lixophaga diatraeae.—Pamphl. Dep. Sci. Agric. Barbados* no. 10, 11 pp., 1 map. Barbados, August 1934. [Recd. June 1935.]

During a survey of 79 fields of sugar-cane in Antigua in May–June 1934, only one field of plant cane was found from which larvae and pupae of *Lixophaga diatraeae*, Tns., could be collected. The 78 puparia obtained in the course of five days gave rise to 72 adults, of which 28 females were dissected. With the larvae thus obtained 1,555 larvae of *Diatraea saccharalis*, F., were inoculated and transported to Barbados where they yielded 735 puparia of the parasite. Breeding will be started with this consignment and paired females will be released in the field.

In a survey of the status of *Lixophaga* in Antigua, current and total parasitism of 6·75 and 4·66 per cent. were estimated from examination of 2,014 individuals of *D. saccharalis* and 5,242 dead hearts collected from 17 fields. These figures are not representative of the entire island since about 40 per cent. of the material came from the field in which the living parasites were found. In the remaining areas total parasitism by *Lixophaga* and *Cordyceps* [*barberi*] averaged less than 1 and over 18 per cent. respectively. The figures for *Lixophaga* were surprisingly small in view of previous findings [*R.A.E.*, A **21** 662].

VEITCH (R.). **Cabbage Pests and their Control.**—*Qd agric. J.* **43** pt. 4 pp. 332–335, 1 pl. Brisbane, 1st April 1935.

The common pests of cabbage in Queensland are *Plutella maculipennis*, Curt. (cabbage moth), which occurs there wherever cabbage is grown, *Hellula* (*Oebia*) *undalis*, F. (centre grub) and *Brevicoryne brassicae*, L. (cabbage aphis). Notes on their bionomics and control are given. Weekly applications of insecticides are necessary against the cabbage moth, and seedlings should be treated every two days. Sprays of derris have proved even more effective than lead arsenate dusts or sprays, and derris dusts have given good results in preliminary trials. The derris sprays are also effective against *Hellula* and the Aphid, but not against the larvae of *Heliothis obsoleta*, F., which may cause severe injury by boring into the hearts of mature cabbages.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **46** pt. 4 pp. 201–205, 6 figs. Sydney, 1st April 1935.

In continuation of this series on insect pests in New South Wales [*cf. R.A.E.*, A **23** 346], notes are given on the bionomics and control of Aphids on various plants, Trypetids on *Citrus* [*cf.* **21** 130], and *Cylas formicarius*, F., and *Herse convolvuli*, L., on sweet potatoes. As the adults of *Cylas* feed on the stems and leaves, they can be killed by

spraying with 1 lb. lead arsenate in 40 gals. water, or by dipping the tops of the plants into the spray fluid when they are being planted out. The same spray can be used against *H. convolvuli*, L. The larvae and adults of the Nitidulids, *Carphophilus hemipterus*, L. and *C. pilipennis*, McLeay, feed on ripe or fermenting fruit, but they only enter the fruit when the surface has been broken.

Cottier (W.). **Aphides affecting cultivated Plants. (I) The Carrot, Parsnip, and Willow Aphid.**—*N. Z. J. Agric.* **50** no. 4 pp. 230–231. Wellington, 20th April 1935.

The introduced Aphid, *Cavariella aegopodii*, Scop., causes serious damage to carrots and parsnips in New Zealand during January or February, when the presence of large numbers on the leaves cause the tops to wilt and the plants to lie prone on the ground. In heavy infestations an offensive smell is given off, and the tops become sticky with honey-dew. The overwintering eggs are laid in the axils of the buds of willow and hatch when these open. Eventually winged forms are produced, and these migrate to carrots, parsnips and *Aciphylla*, on which they begin to appear in November, although they are not usually sufficiently numerous to cause serious damage until after Christmas. Brief descriptions are given of the winged and wingless females. Carrots should not be grown any nearer willows than can be helped. If the area is not too large, infested plants may be sprayed with nicotine sulphate (1 : 800) with the addition of 2–3 lb. soap per 100 gals.

Kuwayama (S.) & Endo (K.). **Studies on the Pea Weevil in Hokkaido. Part I. Spraying Experiments during the young pod Stages of Pea-plant.** [*In Japanese.*]—*Rep. Hokkaido agric. Exp. Sta.* no. 34, pp. 43–63, 1 fldg chart. Kotoni, Sapporo, Japan. (With a Summary in English.)

Since its introduction into Hokkaido in 1912, *Bruchus pisorum*, L., has become widely distributed and very destructive throughout the south-western districts of the Island. Sprays tested against it during 1926–29 included lead arsenate, nicotine sulphate, lime-sulphur and pyrethrum, but the most effective were derris soap and another spray containing rotenone. Three or more applications are recommended during July, while the pods are still young.

Ramakrishna Ayyar (T. V.). **Fruit Flies and their Economic Importance in S. India.**—*Madras agric. J.* **23** no. 4 pp. 127–137, 2 pls., 12 refs. Coimbatore, April 1935.

This paper, which is based on the results of recent investigation, contains a general account of the bionomics and economic importance of South Indian fruit-flies and possible methods of controlling them. Annotated lists of the fruit-flies recorded from South India and of their parasites are appended.

Kirkpatrick (T. W.). **Studies on the Ecology of Coffee Plantations in East Africa. I. The Climate and Eco-climate of Coffee Plantations.**—Imp 8vo, 66 pp., 1 fldg table, 34 graphs (2 fldg), 25 refs. Amani, E. Afr. agric. Res. Sta., & London, Cr. Ag. Colon., 1935. Price 5*s*.

Investigations are in progress in East Africa to determine the relation between the standard climate and the ecoclimate in plantations of

Coffea arabica, the effect of different ecoclimates on insect populations, and the extent to which the deliberate modification of the ecoclimate can limit the abundance of a given insect. The author understands by ecoclimate the complex of meteorological factors in an area inhabited by an animal, whether that area be severely restricted or comparatively spacious. He thinks that no profitable distinction can logically be made between ecoclimate and microclimate, and therefore dispenses with the latter term.

In this paper a detailed account is given of extensive investigations carried out in Kenya Colony from mid-May to early October 1932 and mid-December 1932 to late March 1933. All the usual and most of the extreme types of weather were encountered. Observations were made on the ecoclimate within a coffee plantation and a meteorological station was set up about 100 yds. away to determine the standard climate. Series of graphs and tables present a thorough analysis of these data, and the conditions that were recorded in the coffee plantation are correlated in detail with those of the standard climate. An account is given of the influence of the more common and important factors that modify the climate of a coffee plantation, namely, the slope of the ground, the spacing of the bushes, pruning, shade, wind-breaks, cover-crops and mulches. In general it may be considered that the climatic conditions in a coffee plantation differ widely from those that obtain in a standard meteorological screen, but that it is possible, at least during the more usual types of weather, to deduce with fair accuracy the manner in which they will vary.

The author believes that natural enemies are less important in limiting the increase of an insect species than climatic conditions and that its numbers are for the most part regulated even more by the cumulative effect on fertility and mortality of quite small climatic variations than by the lethal results of extreme weather conditions. From his observations he concludes that the variations found in habitats only a few yards apart are greater than the variations in ecoclimate required to produce differential rates of increase. He discusses A. J. Nicholson's theory [*R.A.E.*, A **21** 369], which he considers essentially erroneous, since it involves a confusion between control of density by balance, for which it may well be true, and control in the sense of reduction of density to a point where economic damage becomes negligible. The increase of populations is undoubtedly influenced by climate, and the statement that any factor having the necessary property for the control of populations must be some form of competition [*cf. loc. cit.*] is not true. Control can be equally well effected by factors, such as climate, that are in no way governed by the density of the population.

CHORLEY (J. K.) & MCCHLERY (R.). **Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts.**—*Rhod. agric. J.* **32** no. 5 pp. 322–326; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 954, 5 pp. Salisbury, S. Rhodesia, May 1935.

As it has been alleged that large numbers of natural enemies of locusts, and particularly the European white stork (*Ciconia alba*), are poisoned by the use of sodium arsenite as a locust poison in Southern Rhodesia, experiments were made to determine the dosage of arsenic in the form of locust powder (sodium arsenite containing 80 per cent. As_2O_3) lethal to poultry and the effect of feeding them on poisoned locusts (*Nomadacris septemfasciata*, Serv.) [*cf. R.A.E.*, A **18** 452;

22 687]. The results, which are tabulated, show that the lethal dose is between 0·5 and 0·75 grains for a bird weighing between 5 and 7 lb. Only one bird, which weighed 6 lb., was tested with poisoned locusts. It refused to eat hoppers that had been sprayed and dried in the air, but it ate readily a moist mash containing 50 per cent. by weight of poisoned hoppers. It consumed a total of 8·37 grains of arsenic (As_2O_3) in 18 days. During the final 12½ days it consumed without any ill effects 7·5 grains of arsenic or 0·6 grains per day (about the lethal dose of the first series of experiments), and it improved in appearance and gained 4 oz. in weight. Over a short period it excreted a slightly greater amount of arsenic than it consumed in the same period. It is concluded that when arsenic is administered in small quantities such as occur in sprayed locusts, fowls can tolerate comparatively large doses over a long period without any visible bad effects. They can be fed on locusts sprayed at normal strength without any danger, as it appears to be impossible for them to consume sufficient locusts in one day to obtain a lethal dose.

Notes on Termites and Anti-Termite Work.—vii+23 pp., 16 refs. Kaduna, Public Works Dep., Nigeria, 1935.

Information derived from diverse sources is given on the habits and control of termites, especially those that attack timber work and furniture in buildings. Particular reference is made to conditions in Nigeria, where eight injurious species have been identified, namely, *Coptotermes sjöstedti*, Holmgr., *Calotermes* (*Cryptotermes*) *havilandi*, Sjöst., *Macrotermes nigeriensis*, Sjöst., *M. bellicosus*, Smeath., *M. natalensis*, Hav., *Eutermes* (*Nasutitermes*) *ibidanicus* Sjöst., *Microtermes sudanensis*, Sjöst., and *Termes* sp. near *amanicus*, Sjöst.

Săvulescu (T.) & Rayss (T.). **Putrezirea uscată a stiuleţilor de porumb în România.** [Diseases of Maize in Rumania.]—*Anal. Inst. Cerc. agron. Român.* **5** pp. 3–112, 42 figs., 94 refs. Bucarest, December 1933. (With a Summary in French.) [Recd. June 1935.]

In the course of this paper on diseases of maize, the author states that in Rumania, both in the field and in stores, *Sitotroga cerealella*, Ol., carries the spores of the fungus, *Nigrospora oryzae*, that causes dry rot of the ears of maize.

Le Pyrèthre. Culture et Utilisation.—*Tract Dir. gén. Agric.* Sér. A (Phytotech.) no. 1, 16 pp., 5 refs. Brussels, Minist. Colon. [1935.] Price *Fr.* 1.

A short account is given of the cultivation and preparation for the market of pyrethrum, the extent to which its production has been undertaken in various countries (including the Belgian Congo where the industry was started two years ago) and the commercial returns that may be expected. The botanical characteristics of *Chrysanthemum roseum* and of *C. cinerariaefolium*, the most important species as a source of the product, are described, and the climatic conditions and types of soil favorable to their growth are discussed. The active principles of pyrethrum, its evaluation by biological and chemical

methods, its action on insects, other animals and man, and its preparation and use as an insecticide are briefly dealt with, and notes are given on the more important of several preparations of it manufactured in Japan.

Listo (J.). **Punkkiäkämissa elävä loispistiäinen.** [A Hymenopterous Parasite living in Mite Galls.]—*Luonnon Ystäväs.* **39** no. 2 pp. 42–45, 1 fig., 4 refs. Helsinki, 1935.

An account is given of the occurrence in Finland of *Tetrastichus eriophyes*, Taylor, parasitising *Eriophyes ribis*, Nal. It was found in large numbers in buds of black currant affected by the galls of the mite in two localities in the southern part of the country and was also reared from birch buds infested by *E. rudis*, Can. (*calycophthirus*, Nal.).

Kangas (E.). **Huomioita mäntypistiäistuhoista. II.** [Observations on Injuries caused by the Pine Sawflies. II.]—*Metsät. Aikak.* **51** no. 1 pp. 9–12, 4 figs., 5 refs. Helsinki, 1934.

A widespread outbreak of sawflies occurred on pines during 1932–33 in Finland. *Diprion* (*Lophyrus*) *sertifer*, Geoffr., seemed to be the most injurious species, particularly in the south. Most of the records of *D.* (*L.*) *pini*, L., were from the north. Only a small percentage of the pines defoliated in one year were killed, and as yet few are dead in localities infested during the two successive years, though trees in these areas seem very susceptible to attack by *Pissodes* and *Myelophilus* (*Blastophagus*). One pine tree that was defoliated in 1931 and 1932 was attacked by *P. piniphilus*, Hbst., during the end of the summer of 1932 and also by *M.* (*B.*) *piniperda*, L., and some minor pests during the summer of 1933.

Lentz (O.) & Gassner (L.). **Schädlingsbekämpfung mit hochgiftigen Stoffen.** [Pest Control with highly poisonous Substances.] **Heft 1. Blausäure. Deckblätter—1. Folge.** [Hydrocyanic Acid Gas. Addenda—1st Series.]—6 pp. Berlin, R. Schoetz, 1935. **Heft 2. Aethylenoxyd (T-Gas.). Deckblätter—1. Folge.** [Ethylene Oxide. Addenda—1st Series.]—8 pp.

These supplements to two booklets already noticed [*R.A.E.*, A **22** 369] contain recent regulations dealing with hydrocyanic acid gas and ethylene oxide in Germany.

Petri (L.). **Rassegna dei casi fitopatologici osservati nel 1934.** [A Review of Phytopathological Cases observed in 1934.]—*Boll. Staz. Pat. veg. Roma* N.S. **15** no. 1 pp. 1–95. Rome, 1935.

This report deals primarily with fungi.

Experiments showed that the employment of commercial bait-sprays containing ammonium sulphate against *Dacus oleae*, Gmel., would not cause scorching on the leaves of olive. If direct measures against *Liothrips* (*Phloeothrips*) *oleae*, Costa, are economically warranted, a spray of 4 lb. potash soap, 3 lb. kerosene, 3 lb. tobacco extract and 20 gals. water should be applied three times at monthly

intervals, coinciding with the presence of larvae of the three generations. It should not, however, be applied when the trees are in blossom.

An extensive plantation of *Quercus ilex* was severely infested by *Phylloxera quercus*, Boy.

MASSEE (A. M.). **Notes on Mite and Insect Pests for the Year 1934.**— *Rep. E. Malling Res. Sta. 1934* **22** pp. 165–172. East Malling, Kent, May 1935.

In Kent during 1934, *Tetranychus telarius*, L., which had been favoured by the warm summer, caused serious damage to hops. The mites are invariably more common where poles are still used [*cf. R.A.E.*, A **22** 580]. White oil emulsion applied in attempts to destroy mites hibernating in the poles did not penetrate into the minute cracks, but it freed the hops from a severe infestation of *Calocoris fulvomaculatus*, DeG., by killing the eggs. The mites come out of hibernation in April and sprays can be applied during May and June without injuring the bines. The most successful [*cf. loc. cit.*] consisted of 10 oz. potassium sulphide (1 lb. during July or August) and 6 oz. sulphonated lorol in 100 gals. water.

By October 1934, *Aphelinus mali*, Hald., had parasitised most of the woolly Aphids (*Eriosoma lanigerum*, Hsm.), which the warm summer had caused to be very numerous, in a three-acre apple orchard where it had been liberated in the spring of 1933, and had begun to establish itself in an adjoining orchard. In the insectary, *Anuraphis roseus*, Baker, migrated readily from apple to *Plantago major* and *P. lanceolata*, and was also found on these plants in the field. This seems to be the first record of plantains as an alternative food-plant in England. According to field observations on *Tortrix* (*Cacoecia*) *podana*, Scop. [*cf.* **23** 125], the eggs, which are laid in batches from the end of May to the beginning of July on the upper surface of apple leaves, hatch in about 12 days, and the young larvae soon spread to different parts of the tree. Each feeds on the lower surface of the leaf under a silken cover. An extra lead arsenate spray should be applied in July when the oviposition period is over and before the larvae begin to protect themselves by joining two leaves together. The weevil, *Rhynchites aequatus*, L., which bores into developing apples, may be controlled by a single derris dust applied about two weeks after the petals fall. Spraying with lead arsenate and dusting with derris were ineffective against *Anomala* (*Phyllopertha*) *horticola*, L., which caused considerable damage by feeding in the fruits of apple in Surrey, Kent and Norfolk.

An unusual infestation of raspberries by *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) has been reported from Norfolk, and severe damage to Morello cherries was caused at East Malling. Other pests were *Tarsonemus fragariae*, Zimm., on strawberries, *Cydia* (*Laspeyresia*) *pomonella*, L., on apples, *Scolytus* (*Eccoptogaster*) *mali*, Bechst., on plums and cherries, *S.* (*E.*) *rugulosus*, Ratz., on old and neglected damson trees, and the larvae of *Hepialus humuli*, L., *Melolontha melolontha*, L. (*vulgaris*, F.), *Otiorrhynchus singularis*, L., and *O. sulcatus*, F., all feeding on the roots of strawberries and causing the plants to wilt and die. Apple grafts were attacked by *O. singularis* and *O. clavipes*, Bonsdorff, which may be controlled by painting the grafts with lead arsenate.

Massee (A. M.). **Notes on the Strawberry Aphis** (*Capitophorus fragariae* **Theo.**).—*Rep. E. Malling Res. Sta. 1934* **22** pp. 173–176, 5 refs. East Malling, Kent, May 1935.

Thomas (F. J. D.). **Bibliography of Papers dealing with Aphids on Strawberries.**—*T. c.* pp. 177–179.

Observations on the bionomics of *Capitophorus potentillae*, Wlk. (*fragariae*, Theo.), which was abnormally abundant in part of Kent in 1933 and 1934, showed that this Aphid occurs on cultivated strawberry from late August until the following July [*cf. R.A.E.*, A **16** 409], when winged forms appear and the majority of the Aphids probably migrate elsewhere. In winter, the Aphids may sometimes be common, but they do not seem to breed much before the spring. In a greenhouse, winged forms were first noted on 24th March and they were still present at the end of April; colonies occurred until the end of August, whereas in the field the numbers of Aphids dropped considerably after 15th July, but increased again in October. The egg-stage and primary food-plants are unknown. Experiments in the greenhouse showed that *C. potentillae*, although it is found in natural conditions on cultivated strawberry, may also form colonies on other plants, including wild strawberry, *Potentilla sterilis* and *P. anserina*. A table shows the 7 species of Aphids recorded on cultivated strawberry in various parts of the world, their synonymy, food-plants and distribution.

With the intention of helping workers on virus diseases transmitted by Aphids, F. J. D. Thomas contributes, in an appendix, a list of publications (containing 50 titles) on Aphids attacking strawberries.

Greenslade (R. M.), Massee (A. M.) & Thomas (F. J. D.). **Apple Blossom Weevil Experiments in 1934. Impregnation of Tree Banding Materials.**—*Rep. E. Malling Res. Sta. 1934* **22** pp. 180–184. East Malling, Kent, May 1935.

In experiments on a small scale in an apple orchard, corrugated cardboard bands impregnated with preparations of chlorinated naphthalenes and used for trapping *Anthonomus pomorum*, L., did not injure the trees and the weevils were strongly attracted by some of the compounds. They were not, however, affected by the most attractive preparations, and those that killed them were least attractive. Larvae of the codling moth [*Cydia pomonella*, L.] were not prevented from hibernating in the bands, and seemed to be attracted by some of the impregnating materials. They were not injured by any of them.

Greenslade (R. M.). **Laboratory Trials of Wetters against Woolly Aphis** *Eriosoma lanigerum* **(Hausm.).**—*Rep. E. Malling Res. Sta. 1934* **22** pp. 185–190, 2 graphs. East Malling, Kent, May 1935.

In laboratory tests in order to compare the power of wetting agents for sprays against *Eriosoma lanigerum*, Hsm., infested twigs were dipped for 10 seconds in solutions of the various preparations, to which ·025 per cent. nicotine was added, and the number of dead Aphids was counted after 24 hours. This method was first tested with a large range of soft soap solutions and tar-oil emulsions, and proved to be sufficiently accurate to be used for substances of unknown

wetting power. The results are presented in tables and graphs. Of substances added to nicotine, only Agral II was satisfactory, 75 per cent. of the Aphids being killed when it was used at a concentration of 0·5 per cent. Soft soap at twice that concentration with nicotine gave about the same result. There is evidence, however, that Agral II is liable to cause serious cracking and russeting of fruit. Winter washes were similarly tested. At a concentration of 5 per cent., winter petroleum emulsion killed all the Aphids, kerosene emulsion killed 83 per cent., and tar distillate only 16 per cent. In special experiments in which tufts of the wax of the Aphid were floated on the solutions in watch glasses, none of the wetting agents tested had any solvent action on the wax threads, and Agral II had by far the greatest wetting power.

Preliminary tests of the various wetters with lime-sulphur and of other insecticides against the strawberry Tarsonemid mite [*Tarsonemus fragariae*, Zimm.] were unsatisfactory.

Steer (W.). **Studies on *Byturus tomentosus* Fabr. V. 1934 Experiments on the Control of the Raspberry and Loganberry Beetle.**—*Rep. E. Malling Res. Sta. 1934* **22** pp. 191–193, 4 refs. East Malling, Kent, May 1935.

In view of the failure of derris dust to prevent oviposition by *Byturus tomentosus*, F., on raspberry in 1933 [*R.A.E.*, A **22** 582], the experiment was repeated on a larger scale late in May 1934, with derris containing 3·63 per cent. crude rotenone. A china clay dust containing 10 per cent. derris was applied at the rates of 3 cwt. and 1 cwt. per acre, and one containing 5 per cent. derris at the rate of 3 cwt. On plots thus treated the percentage of infested berries averaged 24·2, 31·1 and 25·7, respectively, as compared with 43·6 on the controls.

On loganberries, the larvae were satisfactorily controlled by a single spray of 2 lb. derris per 100 gals. water on 22nd June. It was applied with soap, or incorporated in a mixed wash of 2 gals. lime-sulphur and 6 pints sulphite lye, or of 2 pints colloidal copper (a spray fluid based on copper oxychloride) and 6 pints sulphite lye. The percentages of infested berries averaged 5·3, 9·4 and 5·2, respectively, as compared with 45·9 on the controls

In a small field trial, a spray of derris and soap, applied on 12th July after a few larvae had begun to attack the earlier berries, confirmed the previous year's results [*loc. cit.*]. The percentage of infested fruit was only 2·6, as compared with 22 on the control.

Steer (W.) & Thomas (F. J. D.). **Field Spraying and Dusting Trials on the Control of Apple Blossom Weevil and of Apple Sawfly in 1934.**—*Rep. E. Malling Res. Sta. 1934* **22** pp. 194–204, 10 refs. East Malling, Kent, May 1935.

Experiments in the control of the adults of *Anthonomus pomorum*, L., to prevent the " capping " of the blossoms [*R.A.E.*, A **22** 584] were continued in April 1934, but most of the trials were spoilt by rain. A china clay dust containing 10 per cent. derris and a proprietary preparation (72 per cent. barium fluosilicate, 8 per cent. sodium fluoaluminate) were used. The derris contained 3·63 per cent. crude rotenone. Counts of damaged and undamaged flowers in late May showed that the derris dust had reduced the injury by half. The

other dust was ineffective, evidently because the weevils feed on the mesophyll and are not affected by a deposit of stomach poison on the surface tissues. Spraying the trees with a mixture of nicotine and Agral I did not destroy the eggs.

A detailed account is given of experiments with derris dusts and sprays of nicotine in lime-sulphur against *Hoplocampa testudinea*, Klug, on apples. They confirmed the previous year's results [**22** 583]. In trials to compare their value as ingredients of the spray, derris was apparently inferior to nicotine, though it also considerably reduced the attack whether applied at petal-fall or a week later. Derris dust applied against migrating larvae on 8th June (4 days after the secondary attack on the fruitlets had been observed), reduced the secondary damage by over 76 per cent. [*cf. loc. cit.*]. A dust of barium fluosilicate, which presumably acts only as a stomach poison, was not so effective. The addition of lime-sulphur to a petal-fall spray of lead arsenate [*cf.* **22** 52, 583] a week before the eggs began to hatch did not give better results than lead arsenate alone. Lead arsenate in a petal-fall spray was less effective than lime-sulphur and derris with a wetter. A petal-fall spray of lime-sulphur and nicotine without a wetter destroyed the eggs. If the trees are very heavily sprayed, no wetter need be used, but wetters save time and material. Agral I was successfully used at 1 lb. and Agral N or sulphonated lorol at ½ lb. per 100 gals.

THOMAS (F. J. D.). **Preliminary Experiments on the Control of Apple Surface-eating Tortricid Larvae.**—*Rep. E. Malling Res. Sta. 1934* **22** pp. 205–207, 2 refs. East Malling, Kent, May 1935.

In July 1934 preliminary field trials were carried out in Kent on the control of the larvae of *Tortrix* (*Cacoecia*) *podana*, Scop., on apples [*cf. R.A.E.*, A **23** 125]. A spray of 2 lb. derris and 5 lb. soft soap in 100 gals. water (rotenone content 0·007 per cent.), applied on 26th July about 9 weeks after the petals fell, reduced the injury to the fruit by half. Spraying with a barium fluosilicate preparation (72 per cent. barium fluosilicate, 8 per cent. sodium fluoaluminate and 20 per cent. talc) used at the rate of 4 lb. with 1 lb. Agral N to 100 gals. water, reduced the damage by one third.

MOORE (M. H.). **A Field Spraying Trial of combined Fungicide-Contact Insecticide Sprays in 1933. A Progress Report.**—*Rep. E. Malling Res. Sta. 1933* **21** pp. 156–165, 7 refs. East Malling, Kent, May 1934.

MOORE (M. H.) & MONTGOMERY (H. B. S.). **A Field Spraying Trial of combined Fungicide-Contact-Insecticide Sprays in 1934. A Progress Report.**—*Op. cit. 1934* **22** pp. 208–216, 1 pl., 1 graph, 4 refs. East Malling, Kent, May 1935.

With a view to finding a combined spray that would be effective against apple scab, the sawfly, *Hoplocampa testudinea*, Klug, and caterpillars such as those of the winter moth [*Cheimatobia brumata*, L.], a field trial on a large scale was carried out in 1933. Lead arsenate was omitted from the sprays to determine whether it is necessary when contact insecticides are liberally used. The applications were made at the stages of green-bud (11th April), pink-bud (21st April), petal-fall (15th May) and (lime-sulphur only) three weeks after it

(7th June), and the results, which are tabulated, were worked out by grading the dropped and picked fruit for scab, sawfly and caterpillars. It was found that the sawfly was very effectively controlled by a combined wash of 6 pints lime-sulphur and 8 oz. nicotine to 100 gals. water with 6 pints sulphite lye as wetter and spreader, applied at petal-fall at least 4 days before the eggs hatched. When 2 lb. derris (2·71 per cent. rotenone) was used instead of nicotine, the spray was approximately only half as effective against the sawfly [*cf. R.A.E.*, A **22** 583]. As neither nicotine nor derris greatly reduced the proportion of fruits injured by caterpillars, it appears that it may be necessary to include lead arsenate in the spray programme when there is a severe attack. The sprayed trees were free from *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.), whereas the controls were rusty-coloured by the end of June.

These investigations were continued in 1934 on the same lines, but lead arsenate was incorporated in the green-bud (20th April) and pink-bud (4th May) sprays, no test was made with derris, and in the lime-sulphur and nicotine sprays the spreader was varied. Sulphite lye, sulphonated lorol or a standard preparation " Lethalate " were used at the rate of 6 pints, 1 lb. and ½ lb. per 100 gals. water, respectively. Against the sawfly each programme gave about a 90 per cent. reduction in infestation compared with 84 per cent. in 1933. The authors believe that the efficiency of the treatment may have been wholly due to the application of the combined sprays containing lime-sulphur and nicotine (8 oz. per 100 gals.) at petal-fall before the sawfly larvae hatched. The percentage of fruit infested by caterpillars averaged 2·4 per cent. on the sprayed trees as compared with 4·8 on the controls, but the results were very variable. Trees sprayed three weeks after petal-fall (12th June) with lime-sulphur (1 : 100), nicotine (6 oz. per 100 gals. for Aphids) and spray-gelatine (1 lb. per 100 gals.) were free from red spiders throughout the season, whereas the controls were so severely infested in early June that they had to be sprayed.

There was little difference in efficiency between the three spreaders in relation to scab and sawfly control, but " Lethalate " seemed slightly better in helping the ovicidal action of nicotine against the sawfly.

WILSON (G. F.). **The Rhododendron White Fly.**—*J. R. hort. Soc.* **60** pt. 6 pp. 264–271, 4 pls., 6 refs. London, June 1935.

Information is given on the appearance, bionomics and control of *Dialeurodes chittendeni*, Laing [*cf. R.A.E.*, A **16** 620 ; **17** 257] on rhododendrons. Attack appears to be confined to cultivated rhododendrons in gardens and nurseries in south and south-east England and has been spread by the distribution of infested plants. The females, which are slightly more numerous than the males, deposit about 7 eggs a day over a considerable period. The larvae are present from August until the following April and the pupae in May. Unusually low temperatures during spring and summer in 1931 and 1933, together with less sunshine, prolonged the later stages of the life-cycle. The oviposition period was protracted during 1932. Although some adults may emerge as late as mid-September, there does not appear to be any proof of the occurrence of a second brood [*cf.* **17** 258]. The fact that some rhododendrons are not attacked appears to be due to the presence of hairs, or scales, and to the thickness of the epidermal

layer. Lists are given of the susceptible and resistant varieties. The pupae were found to be parasitised by *Encarsia formosa*, Gah., the parasite of the greenhouse whitefly [*Trialeurodes vaporariorum*, Westw.], but attempts to use it against the rhododendron whitefly would probably be defeated by low temperatures at night between April and early June and by the length of its life-cycle.

Leaves having a mottled and blackened appearance should be removed and burned from September to April. A spray of $1\frac{3}{4}$ pint white oil emulsion, $\frac{3}{4}$ fl. oz. nicotine (96 per cent.) and 10 gals. water may be applied to the lower surface of the leaves. It is best used against the young larvae in September and early October, though it may be applied as late as May. Treatment should be made during dull weather. A 5 per cent. tar distillate wash has frequently proved effective when applied during December–February. In infested nurseries, the leaves of young plants prior to their despatch should be dipped in either of these materials during the dormant season. Those treated with the tar distillate wash may be immersed in clear water after a few hours. The adults on the young growth may be destroyed by 2 or 3 applications of a nicotine dust over a period of 3 weeks in June and the first half of July. In large plantations and shrubberies, it may be necessary to cut and burn branches with infested foliage. This should be done during early spring to allow the dormant buds to break so that the new growth may be completed before the frost can injure it, and to lessen the period during which the bushes are unsightly.

Ripert (J.) & Gaudin (O.). **Sur la toxicité relative de la pyréthrine i et de la pyréthrine ii.**—*C. R. Acad. Sci. Fr.* **200** no. 26 pp. 2219–2220, 2 refs. Paris, 1935.

In testing the effectiveness of the two active principles of pyrethrum by injecting them into frogs, the authors found that pyrethrin II was slightly more toxic than pyrethrin I, but less so than a mixture of equal parts of each.

Zacher (F.). **Die Vorratsschädlinge im Jahre 1934 insbesondere Kornkäfer und Samenzünsler.** [Store Pests in Germany in 1934, particularly *Calandra granaria* and *Aphomia gularis*.]—*Mitt. Ges. Vorratsschutz* **11** no. 3 pp. 31–38. Berlin, May 1935.

In reviewing the measures applicable against *Calandra granaria*, L., the author states that an exposure of 1 hour to 47–47·2°C. [about 116·8°F.] killed all stages without impairing the germination of the wheat. In Egypt, R. Attia found that crude phosphates mixed with flowers of sulphur had a superficial physical action by dehydrating the weevils. In experiments in which magnesium oxide [*cf. R.A.E.*, A **21** 532, etc.] and finely powdered silica (SiO_2) were mixed with infested wheat at the rates of 4 per cent. and 2 per cent. by weight, respectively, the former caused complete mortality in 16 days, but the latter took 5 days longer. An experiment in September 1934 showed that *C. granaria* reproduced just as well in barley of the 1934 crop as in barley of the 1933 crop. Shelled acorns are also suitable for it. The Pyralid, *Aphomia gularis*, Zell., which was collected in Hamburg in June 1934 [**22** 559], required about 6 months to complete a generation at a temperature of 18–20°C. [64·4–68°F.].

Eckstein (K.). **Der Parkettkäfer, *Lyctus linearis* Goeze.**—*Mitt. Ges. Vorratsschutz* **11** no. 3 pp. 38–42, 1 fig. Berlin, May 1935.

This is a survey of present knowledge, and particularly a paper by Kojima [*R.A.E.*, A **20** 657], on *Lyctus linearis*, Goeze, infestation of timber by which has increased considerably in Germany since 1928.

Hering (M.). **Minenstudien 15.** [Studies of Leaf-mining Insects, 15.] —*Z. PflKrankh.* **45** no. 1 pp. 1–15, 11 figs., 8 refs. Stuttgart, 1935.

Among the new species described is an Anthomyiid, *Helina buhri*, from orchids (*Orchis latifolia* and *O. maculata*) in North Germany.

Deutschmann (F.). **Die Blutlauszehrwespe in Südmähren.** [The Woolly Aphis Parasite in South Moravia.]—*Z. PflKrankh.* **45** no. 1 pp. 41–44, 2 figs. Stuttgart, 1935.

In 1933 the author imported into South Moravia from Italy apple twigs infested with the woolly aphis [*Eriosoma lanigerum*, Hsm.] parasitised by *Aphelinus mali*, Hald. The parasite survived the winter and had a sufficient number of generations in the summer of 1934 to keep the Aphid in check.

von Tubeuf (C.). **Werdegang der Erforschung der sog. Ulmenkrankheit in Europa.** [The Development of Investigation on the so-called Elm Disease in Europe.]—*Z. PflKrankh.* **45** nos. 2 & 4 pp. 49–78, 162–189, 12 figs., many refs. Stuttgart, 1935.

Lüstner (G.) & Gante (T.). **Bemerkungen zum Ulmensterben.** [Notes on Elm Mortality.]—*T.c.* no. 2 pp. 79–97, 79 refs.

The first of these papers is a critical survey of the literature on elm disease caused by *Ceratostomella ulmi* in Europe. In the second it is concluded after a discussion of the literature and of original observations that elms must be in a receptive condition to acquire infection, which may be temporary or fatal. Receptivity depends on the variety of elm and is increased by such external conditions as drought. Where bark-beetles are concerned, the fungus spores are more likely to be introduced through brood mines and larval mines than through lesions in the shoots due to maturation feeding.

Zillig (H.). **Ausgestorbene und selten gewordene Rebenfeinde im deutschen Weinbau.** [Grape Vine Pests and Diseases that have become extinct or rare in German Viticulture.]—*Z. PflKrankh.* **45** no. 4 pp. 210–227, 21 refs. Stuttgart, 1935.

With the object of showing that many pests and diseases of the grape-vine have disappeared or become scarce in Germany since the general application of modern measures of control, those observed during the past 15 years are noticed in order of importance. *Adoxus obscurus* var. *villosulus*, Schr. (*vitis*, auct.), *Byctiscus betulae*, L., *Otiorrhynchus sulcatus*, F., and *Sparganothis pilleriana*, Schiff., have since 1922 become of negligible importance owing to the general use

of arsenical insecticides against *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff. *Pulvinaria vitis*, L., has also become unimportant as a result of the greater care given to vines.

WATZL (O.). **Beobachtungen über den Lebenslauf der San José-Schildlaus in Mitteleuropa.** [Observations on the Life-history of the San José Scale in Central Europe.]—*Landeskultur* **1** no. 3 pp. 64–66. Vienna, 1934. (Abstr. in *Z. PflKrankh.* **45** no. 6–7 p. 377. Stuttgart, 1935.)

Observations in 1932 and 1933 on the development of the San José scale [*Aspidiotus perniciosus*, Comst.] on fruit trees, etc., near Vienna indicated that it produced a partial second generation in a year [*R.A.E.*, A **22** 718]. The larvae were only able to survive the winter if they had acquired scales. Summer generation larvae that had migrated to foliage all perished, and the progeny from females settled on the fruits in autumn had little chance of survival. For these reasons there can be no rapid increase of this Coccid in Central Europe.

KANGAS (E.). **Zur Kenntnis der Larven der *Pissodes*-Arten Finnlands.** [A Contribution to the Knowledge of the Larvae of the Species of *Pissodes* in Finland.]—*Metsät. Tutkimus. Julk.* **20** no. 3 reprint 25 pp., 10 figs., 8 pls., 12 refs. Helsinki, 1935. (With a Summary in Finnish.)

This paper is published in view of the need for identifying the larvae of the weevils of the genus *Pissodes* found in Finland, where the bark-breeding species cause considerable injury, especially to pines.

One Finnish species, *P. gyllenhali*, Sahlb., which was observed in spruce as well as in pine, is omitted because of its rarity. The larvae dealt with are those of *P. pini*, L., *P. notatus*, F., *P. piniphilus*, Hbst., and *P. validirostris*, Gyll., all from pine, and *P. harcyniae*, Hbst., from spruce. *P. validirostris* infests the pine-cones. Descriptions of the larvae of these species and a key to them are preceded by notes on the differences between larvae of *Pissodes* and those of *Hylobius abietis*, L., and allied species.

VAPPULA (N. A.). **Notes on the Occurrence of some Insect Pests in northern Finland (Prov. Ob) in Summer 1933.**—*Notul. ent.* **15** no. 1–2 pp. 37–39. Helsinki, 1st May 1935.

Insects observed in June 1933 in the Tornio river valley included *Charaeas graminis*, L., in grasslands; *Incurvaria capitella*, Cl., and *Thamnonoma wauaria*, L., on black and red currants; *Notolophus* (*Orgyia*) *antiquus*, L., *Monima* (*Taeniocampa*) *gothica*, L., *Pachynematus pumilio*, Knw., and *Plesiocoris rugicollis*, Fall., on black currants; *Pteronus ribesii*, Scop., on red currant and gooseberry; and *Capitophorus* (*Cryptomyzus*) *ribis*, L., on red currant.

HELLÉN (W.). *Orchestes fagi* **L., en för Finland ny skalbagge.** [*Rhynchaenus fagi*, a Beetle new for Finland.]—*Memor. Soc. Fauna Flor. fenn.* **10** p. 76. Helsinki, 1935.

Rhynchaenus (*Orchestes*) *fagi*, L., which has not before been recorded from Finland, has been found there on beech.

Listo (J.). **Ueber das Auftreten des** *Malacosoma neustrium* **L. (Lep.) in Finnland.** [On the Occurrence of *M. neustria* in Finland.]—*Notul. ent.* **15** no. 1–2 pp. 39–42, 11 refs. Helsinki, 1st May 1935.

Malacosoma neustria, L., was found on an apple tree in Finland in 1934. The author discusses previous records of its occurrence in Finland and gives reasons for thinking that they actually referred to *M. castrensis*, L.

[Sokolov (A. D.).] **Соколов (А. Д.).** Ed. **Pests and Plant Diseases discovered by Quarantine Inspection.** [*In Russian.*]—Cr. 8vo, 68 pp. Leningrad, Lenoblizdat, 1934. (With Summary in English.) [Recd. June 1935.]

This report of the Leningrad Quarantine Inspection Service, which is the result of the collaboration of 12 workers, opens with a survey of the development of plant quarantine laws in the Russian Union since April 1873 and a brief review of the activity of the Leningrad Service in 1932 and 1933. This is followed by lists of the insects and fungi intercepted on plants and in seeds and plant material from various countries during these years. They are arranged in tabular form, showing the pests and plants, etc., under their scientific names, the part attacked, the frequency of occurrence of the pest, the country of origin, the date of the inspection, and the treatment applied. Each list is supplemented by indices to the plants and countries, showing the pests concerned. In all, 200 cases of the occurrence of insects were observed.

[Moroshkina (O. S.).] **Морошкина (О. С.). On the Injury caused by** *Trigonotylus ruficornis*, **Geoffr. to Spring Wheat.** [*In Russian.*] —*Social. Grain Fmg* **5** no. 2 pp. 125–128, 1 fig., 3 refs. Saratov, 1935.

During observations in 1931–34 on the development of cereals on an experiment farm in the North Caucasus, *Trigonotylus ruficornis*, Geoffr., was found on wheat, oats and barley. The larvae appear in the second half of May, and the mass flight of the adults in the first 10 days of July coincides with the milk ripeness of spring wheat and oats. After harvest, the Capsids feed on self-sown cereals and wild grasses, from which they migrate in small numbers to sprouting winter wheat. The results of laboratory experiments, in which isolated wheat plants were each infested with 50 bugs collected in the field, are tabulated and expressed mathematically. They show that infestation of spring wheat reduces the number of large grains in the ears and increases the number of small and brittle ones. Infested plants yielded 26·5 per cent. less by weight of grain than normal ones.

[Paramonov (A. Ya.).] **Парамонов (А. Я.). Zur Frage nach dem Einfluss der Beschädigung durch** *Porthetria dispar* **in Betreff des Eichenzuwachses in der Krim.** [On the Question of the Effect of Injury by *P. dispar* in Relation to the Growth of Oak in the Crimea.] [*In Ukrainian.*]—*Trav. Mus. zool. Acad. Sci. Ukr.* no. 13 pp. 97–110, 3 graphs, 2 refs. Kiev, 1934. (With Summaries in Russian and German.) [Recd. June 1935.]

In preliminary investigations during September 1932 in southern Crimea on the effect of infestation by *Porthetria dispar*, L., on the

development of oaks, a number of oaks 60–80 years old and beeches (with ash trees, which are not attacked by the moth, as a control) were felled in different parts of a forest, and their growth for 24 years (1909–32) determined by examining cross sections cut from the trunks. Outbreaks of the moth had occurred in 1909–13, 1918–22 and 1928–32. A comparison of the mean annual growth of the trees in each individual year with the amount of precipitation during April–July, and again of the mean growth in normal years with that in the years of outbreaks, established a close relation between the growth and the amount of moisture, and, particularly in the case of the oak, between the growth and the attacks of the moth. In years of infestation both beech and oak suffer worse when the weather is dry. A tree loses from 30 to 50 per cent. of its growth in bulk during outbreaks. Most of the damage is caused in the third and fourth years of an outbreak. In the fifth the infestation usually dies out, but the rate of growth remains very low. The effect of infestation is associated with a complex of other factors, and the absolute loss in wood increases with the quality of the stand. Good stands, however, recovered in the years following an outbreak much more quickly than those growing in worse conditions. The loss is great enough to justify silvicultural measures of control and aeroplane dusting.

[Paramonov (A. Ya.). **Парамонов (А. Я.). Notizen über Forstentomologie.** [Notes on Forest Entomology.] [*In Ukrainian.*]—*Trav. Mus. zool. Acad. Sci. Ukr.* no. 13 pp. 111–118, 4 figs., 1 graph, 3 refs. Kiev, 1934. (With Summaries in Russian and German.) [Recd. June 1935.]

In June 1932, the Noctuid, *Minucia lunaris*, Schiff., which had not previously been recorded as a forest pest in the Russian Union, infested young plantations of oak in the Odessa Department over an area of about 2,500 acres. The adult, larva and pupa are described. There are probably two generations a year, the adults of the first being on the wing in July and the larvae of the second presumably feeding on the late shoots of oaks. The larvae attack only the tender shoots of young oaks and poplars. They pupate in litter and, in the absence of it, probably in the soil. Mature larvae are destroyed by the Carabid, *Calosoma sycophanta*, L., and by birds. To safeguard oaks from infestation, the cultivation of mixed stands is recommended. Control measures include hand-collection of the larvae, the removal and burning of litter to destroy the pupae, and dusting, preferably from the air.

In mixed forests in the North Caucasus at the end of the summer of 1931, *Taphrorychus villifrons*, Dufour, was the most common of all the bark-beetles present on unbarked cut trees. It occurred chiefly on oak, beech and *Carpinus*, but was sometimes found on chestnut and pear, and once on ash (*Fraxinus excelsior*). Its occurrence on the last two trees has not previously been recorded, and was probably due to conditions of overcrowding, which compelled it to infest unusual food-plants.

Observations on the Buprestid, *Lampra* (*Poecilonota*) *rutilans*, F., carried out in forests in the Ukraine and northern Caucasus in 1930–33, showed that it does not attack all standing lime trees exposed to light, but only such of them as are definitely weakened, or have been suddenly exposed to light by strip felling. In infested trees 88 per cent. of the

exit holes occurred on the side turned to the sun. Control measures should be carried out on the same lines as have been recommended against *Cerambyx cerdo*, L., on oak [*R.A.E.*, A **17** 147].

Russo (G.). **Il raggrinzimento o arricciamento del cotone nella Somalia Italiana.** [The Crinkling or Curling of Cotton in Italian Somaliland.]—*Relaz. Monogr. agrar.-colon.* no. 37 43 pp., 14 figs. Florence, 1935.

An account is given of observations and experiments made in 1930 in Italian Somaliland from which the author concludes that leaf-curl of cotton there is not due primarily to Jassids or Aleurodids [*R.A.E.*, A **20** 339].

Ballard (E.). **Report of the Entomological Service.**—*Rep. Dep. Agric. For. Palestine 1933–34* pp. 143–148. Jerusalem, 1934. [Recd. June 1935.]

An outline is given of the difficulties encountered in the campaign against *Chrysomphalus ficus*, Ashm. (black scale) on *Citrus* in Palestine. Compulsory fumigation was carried out by Government contractors, but an increasing number of grove owners made private arrangements for the work. Data on the cost and effectiveness of two applications of each of two oil emulsions against this Coccid are appended. Against the red scale [*Aonidiella aurantii*, Mask.] spraying was found to be very much less effective than fumigation. Other pests studied included *Capnodis* spp., which attack the roots of stone fruit trees, and *Cydia* (*Carpocapsa*) *pomonella*, L., on apple.

Johnston (W. C.) & Gross (F. C. C.). **Some Field Observations on the Grasshopper Pest, with Details of Trapping Experiments conducted at Snowtown.**—*J. Dep. Agric. S. Aust.* **38** no. 9 pp. 1072–1081, 6 figs. Adelaide, 15th April 1935.

An account is given of the results of investigations on the use of traps against *Chortoicetes terminifera*, Wlk., which caused widespread injury to wheat in South Australia in 1934 [*cf. R.A.E.*, A **22** 565], together with information on a further outbreak that occurred throughout the Lower North during the end of 1934 and the beginning of 1935. The entire life-cycle occupies about 3 months. Migrating adults do not appear to favour timbered country and lines of trees cause them to change the direction of flight, since they usually travel parallel to timber instead of flying over the trees. Migration is stopped by a south wind, probably because low temperatures invariably accompany it. The grasshoppers spend any forced delay in their migratory flights in feeding and ovipositing, and cool weather early in 1935 was largely responsible for the widespread distribution of eggs. Oviposition is usually confined to hard, well drained land with little vegetation, but in these investigations eggs were found in pea stubble a week after reaping, wheat stubble, fallow (carrying a well prepared mulch), and grass growing thickly and in patches. In summer, heavy mortality occurred among the newly hatched hoppers despite the abundance of such green food as lucerne or grass. The migrating hoppers always go with the wind and travel rather down hill, along sheep tracks,

down the beds of streams and across fallows than through dry grass. Although they were frequently observed to hop as high as 2 ft. when disturbed, a barrier 1 ft. high usually prevented them from moving forward, if they could not easily crawl over it.

In all trapping experiments barriers were formed by sheets of zinc cut into strips 1 ft. wide in order to direct rapidly advancing hoppers into specially constructed pits with sheets of zinc overhanging the edges. The first type of trap consisted of a pit in a stream bed and the second of a length of trench dug across the line of advance. With the first trap the grasshoppers managed to escape through the interstices of the rock and gravel, but in a less stony situation this type would probably offer a useful means of control. The chief disadvantage of the second was the cost of construction. The third type consisted of a barrier of sheeting along the line of which were constructed five pits. In one, the entrance was made by curving a sheet of zinc into the back of the pit and in two by employing V-shaped races of sheeting, whereas in the other two the sheeting was taken across the middle of the length of the pit. This last kind of pit was the most successful and had the additional advantage that in the event of a change of wind it would still be effective as a trap for many of the migrating hoppers.

Swan (D. C.). **A Weevil attacking Mallow** (*Malva parviflora* **L. and** *M. nicaeensis* **All.) in South Australia.**—*J. Dep. Agric. S. Aust.* **38** no. 9 pp. 1125–1128, 6 figs. Adelaide, 15th April 1935.

Observations on *Ethemaia sellata*, Pasc., attacking malvaceous weeds (*Malva* spp.) in South Australia during 1933 are described. It appeared that both adults and larvae usually shelter in débris or in the soil by day and attack the leaves at night. Eggs are laid on the leaves and pupation occurs in the soil. This weevil has been recorded as a pest of fruit trees, shrubs and vines [*R.A.E.*, A **15** 216], but the author has not found it feeding on other than malvaceous plants.

Cottier (W.). **Red-mite Control by Oil-sprays.**—*N.Z. J. Sci. Tech.* **16** no. 5 pp. 261–270, 8 figs. Wellington, N.Z., March 1935.

In laboratory experiments carried out in New Zealand in 1933, apple twigs infested with winter eggs of *Paratetranychus pilosus*, C. & F., and of *Bryobia praetiosa*, Koch, were dipped in emulsions of 20 petroleum oils, which varied mainly in the viscosity of the oil and the type of emulsifier used. The method of determining the number of eggs killed and the manner in which the twigs were kept and examined are described. The tests were made in 5 series to allow for any differences due to change in susceptibility of the eggs as spring approached. The results, which are given in tables and graphs, show that for the most part the mortality was higher in eggs of *B. praetiosa* than of *P. pilosus* even with stable emulsions, although in several cases all the eggs of both species were killed. In the stable or slow-breaking emulsions, oils with a high viscosity did not necessarily give satisfactory kills of the eggs of *P. pilosus*. Of 2 emulsions containing oils with the same viscosity, the oil with the lower volatility gave better control, particularly in the case of *P. pilosus*. The type of

emulsifier greatly influenced the effectiveness of the oil, and quick-breaking emulsions were more satisfactory, especially with *P. pilosus*, than slow-breaking ones.

MILLER (D.) & CLARK (A. F.). **Control of Forest Insect Pests. Distribution of Parasites in New Zealand.**—*N.Z. J. Sci. Tech.* **16** no. 5 pp. 301–307. Wellington, N.Z., March 1935.

An account is given of recent work on the biological control of forest pests that have lately become of importance in New Zealand. *Hylastes ater*, Payk. (European bark-beetle) occurs on 4 species of pines [*cf. R.A.E.*, A **20** 719] over a broad central belt of country in North Island and in three northern provinces of South Island. Its ability to breed in dead and dying trees and trees damaged by fire gives it a chance to become a major pest of introduced conifers. As no predators or parasites of *H. ater* have been found, a consignment of 3,711 adults of the Nitidulids, *Rhizophagus ferrugineus*, Payk., *R. dispar*, Payk., and *R. bipustulatus*, F., was obtained from the Laboratory of the Imperial Institute of Entomology in England. They were kept during transit in the ship's cool store, and on arrival were placed in a temperature of 41°F. until removed for liberation in 7 localities. The beetles are inactive at low temperatures. They are very voracious, and some devoured each other during distribution. They lay their eggs in the burrows of the bark-beetle, upon the larvae and eggs of which both larvae and adults feed readily. A few of the beetles were kept for rearing in the laboratory and larvae have been obtained from them.

Chermes pini, L., has long infested pine, especially some two-needle pines, throughout the Dominion, particularly in younger stands. When pines are planted in unfavourable sites and where the rainfall is unduly low, severe infestation causes the foliage to die and the stems and lateral branches to become contorted, and the trees may be killed. In less severe cases on young trees, the check to growth after planting, inevitable in introduced conifers, is accentuated, with the result that there is a considerable loss in growth over the earlier years. Although spruce (*Picea*) is the primary food-plant of *C. pini* in Europe, where several other conifers serve as secondary food-plants, in New Zealand, except for one record from *Abies*, it has only been found on *Pinus*. Reproduction takes place throughout the year, eggs laid by wingless, parthenogenetic females giving rise to females of the same kind. Five overlapping generations have been recorded and eggs may always be found. In the spring winged females are produced that feed on the tips of the needles and do not seem to migrate. The larvae that hatch from their eggs, however, are apparently killed by the winter. Native natural enemies include *Drepanacra binocula*, Newm., *Micromus tasmaniae*, Wlk., and *Syrphus novae-zelandiae*, Macq. Of these, *D. binocula* is the most frequent but none exert much control. Six consignments of larvae of *Leucopis* sp., on twigs infested with *C. pini*, and adults of *Hemerobius stigma*, Steph., have been received from England. *Leucopis* lays its eggs amongst colonies of *C. pini*, and the larvae feed on all stages. They pupate on the pine twigs or under a loose piece of bark. Attempts to rear *Leucopis* in glass and gauze cages placed over small trees of *Pinus radiata* heavily infested with *C. pini* were unsuccessful, probably because of unfavourable

weather. No work was carried out with *H. stigma*, as it was considered possible that the larvae might attack those of *Leucopis*, and as the related New Zealand Hemerobiids are heavily parasitised. From 170 adults of *Leucopis* liberated in 9 places between May and September, only 3 eggs and 3 larvae have been found in August and September, respectively, on twigs in the field. The larvae pupated but adults failed to emerge.

Eriococcus coriaceus, Mask. (gum-tree scale), which was first recorded in New Zealand in 1900 [*cf.* **6** 535] and in the Nelson Province in 1932, infests *Eucalyptus* spp., especially *E. globulus*. In its distribution it has followed the prevailing winds and has spread rapidly. The Coccinellid, *Rhizobius ventralis*, Erichs., which was introduced about 1905 [*loc. cit.*], has become established wherever *Eriococcus* is present and, except in heavy infestations, exerts efficient control. The Coccid has 2, and in some districts probably 3, generations a year. From shipments of *Pseudoleucopis benefica*, Meyer, *Stathmopoda melanochra*, Meyr., *Catoblemma mesotaenia*, Turn., and *Creobota coccophthora*, Turn., received from Australia in 1932, only 6 adults of *S. melanochra* were liberated. Neither *Catoblemma* nor *Creobota* survived the journey. A further consignment of *S. melanochra* was sent at the end of the 1933–34 season from which 91 adults were liberated. In the laboratory oviposition was obtained without difficulty. The eggs are placed amongst a colony of the scale and are usually deeply set between 2 adult scales. On hatching the larva feeds upon the colony and constructs a long silken tube or burrow as it proceeds.

Pagden (H. T.) & Lever (R. J. A. W.). **Insects of the Coconut Palm and the Present Position of the Coconut Problem in the British Solomon Islands Protectorate.**—*Brit. Solomon Is. agric. Gaz.* **3** no. 1 pp. 2–22, 40 figs., 14 refs. Tulagi, January 1935. [Recd. June 1935.]

This paper contains a brief general discussion of the status of insect pests of the coconut palm in the British Solomon Islands, together with annotated lists containing about 60 insects, which are classified as definite pests of coconut, insects associated with the coconut palm but normally causing no material damage, and insects infesting stored copra.

Franssen (C. J. H.). **Een tweetal plagen van de mangga : I. Het paarse mangga-rupsje** (*Philotroctis eutraphera* **Meyr.). II. De manggatak-snuitkever** (*Cryptorrhynchus goniocnemis* **Marsh.).** [Two Pests of Mango. I. The mauve Mango Fruit Borer, *P. eutraphera*. II. The Mango Twig Weevil, *C. goniocnemis*.]—*Landbouw* **10** pp. 281–291. Buitenzorg, 1935. (With a Summary in English.)

Brief descriptions are given of the various stages and the bionomics of two minor pests of mango in Java. The eggs of the Pyralid, *Philotroctis eutraphera*, Meyr., are laid on the young fruits and their stalks and hatch in 3 days. The larval stage lasts 9–12 days in young fruits and 15 days in ripe fruits. Young shoots are rarely attacked. The pupal period, which is passed in an earthen case in the ground, averages 10 days. The female moths live about 7 days, and in the laboratory

laid about 130 eggs each. Infestation causes the young fruits to drop and may be prevented by enclosing the fruits in cloth bags. A Braconid, which proved unimportant, was the only parasite observed.

Cryptorrhynchus goniocnemis, Mshl., lays its eggs in cavities in branches at least $\frac{1}{4}$ inch in diameter. The larvae bore downwards and pupate in their mines. The adults feed on the epidermis of the underside of the young leaves, on the buds and on the bark of young shoots. The egg, larval and pupal stages lasted 7, 55 and 10 days, respectively. The adults lived for up to 142 days. Oviposition began 10 days after emergence, a maximum of 15 eggs per female being observed in the laboratory. The control measure recommended is spraying the young leaves with a 1 per cent. suspension of lead arsenate.

Corbett (G. H.), Yusope (M.) & Hassan (A.). **The Attraction of *Necrobia rufipes* De Geer (the Copra Beetle) to the fatty Acids of Coconut Oil and to Types of Copra.**—*Malay. agric. J.* **23** no. 5 pp. 217–228, 1 pl. Kuala Lumpur, May 1935.

Numerous experiments were carried out in Malaya during 1932 and 1934 in the laboratory and copra stores to test the attractiveness of oleic acid to *Necrobia rufipes*, DeG., and to compare its efficiency as a bait with other fatty acids (alone and in combination), various oils and different types of copra. The beetle seemed to be attracted more to lauric and myristic acids than to other fatty acids of coconut oil and preferred the mixed fatty acids to the oils of coconut and oil palm kernel [*cf. R.A.E.*, A **20** 399]. Large numbers of *Ahasverus* (*Silvanus*) *advena*, Waltl, but not of *Carpophilus dimidiatus*, F., were attracted to oleic acid, and the numbers of *Necrobia* were insufficient to warrant its use as a control measure [*cf.* **22** 25]. *Necrobia*, like *Ahasverus* and *Carpophilus*, was chiefly attracted to slimy, degenerated copra with or without moulds on the surface. It therefore appears that if good quality copra were produced, the use of traps and the regular fumigation of copra stocks at the port of shipment would be unnecessary.

Ho (W. C.). **Taxonomy, Distribution and Economic Importance of Chrysomelidae in Szechwan. i. Notes on Collecting Trips in south western Szechwan. ii. The Chrysomelidae of Szechwan.**—*J. W. China Border Res. Soc.* **6** pp. 142–161, 1 pl. Chengtu, 1933–34. [Recd. June 1935.]

Of the 15 species dealt with, those of economic importance are *Colaphellus bowringi*, Baly, of which the larvae and adults damage turnips very severely by feeding on the leaves, and the Halticid, *Podontia lutea*, Ol., which attacks the leaves of the varnish tree (*Rhus vernicifera*).

Nichol (A. A.) & Wehrle (L. P.). **The Olive Parlatoria, *Parlatoria oleae* Colvée, in Arizona.**—*Tech. Bull. Ariz. agric. Exp. Sta.* no. 56 pp. 201–235, 15 figs., 15 refs. Tucson, Ariz., 15th April 1935.

The first part of this paper on the life-history and ecology of *Parlatoria oleae*, Colv., in and near Tucson, Arizona, is by Nichol, and the second on its economic significance and control by Wehrle. This Coccid is recorded from 41 species of plants, of which olive, *Elaeagnus*,

almond, apricot, peach and plum are among the most important. On most plants it is usually found on the mid-ribs of the leaves, on the stem and on the blossom, but on olives it is commonest on the small twigs, mid-ribs and fruit, on *Elaeagnus* on the upper surface of the foliage, and on apples and pears on the fruit and depressed areas in the bark. The males are absent during November–February, eggs during December–January, and first instar larvae during January–February. The females lay 50-100 eggs, which hatch after an average of 20 and 15 days about mid-April and mid-July for the first and second broods, respectively. Large flights of males have been observed in the first week of July and the third week of October. The scales are attacked by an unidentified Coccinellid and its larvae and by a Hymenopterous parasite (probably *Aspidiotiphagus citrinus*, Cwfd.), neither of which are abundant. The source of the present infestation appears to be deciduous fruit trees planted in 1891 and possibly almond trees obtained in 1895. The pest, which apparently has only once before been reported from the United States [*R.A.E.*, A **18** 395], existed for many years in restricted numbers on a limited number of plants ; the rapid increase that has occurred recently in its local distribution is attributed to the mildness of the winters since 1924, which apparently produced physiological changes in many plants. It is suggested that the scale will cease to be numerous as soon as the winter temperatures return to normal or below. Care should be taken to prevent its establishment in the Salt River Valley, where the minimum temperatures are higher, since not more than 5–10 per cent. of the olive crop can be tinned or pickled once the Coccid has become established.

An attempt was made in June and July 1932 to eradicate *Parlatoria* by removing the leaves, twigs and small branches of olive and applying a 2 or 3 per cent. oil emulsion followed by hydrated lime and water to afford protection against the sun. Although these measures caused a high mortality, they were discontinued because they injured the trees and because of the wide distribution of the scale on many food-plants. Trees that had not been defoliated were treated once with an oil emulsion at strengths of 2–4 per cent. during June–July and again at 3 per cent. during September. Counts made in October showed that two applications at 3 per cent. caused 65·85 per cent. mortality on the fruit and 93·11 on the leaves, with a total average of 81·06. One application at 4 per cent. showed 95·16 per cent. mortality on 8th August. The programme as a whole destroyed 69·59 per cent. of the Coccids on the fruit and 92·32 of those on the leaves. What proportion can be attributed to either the first or second application alone is doubtful. No apparent injury was caused to the olive trees.

CLAUSEN (C. P.). **Insect Parasites and Predators of Insect Pests.**— *Circ. U.S. Dep. Agric.* no. 346, 21 pp., 15 figs. Washington, D.C., March 1935.

A general account [*cf. R.A.E.*, A **21** 652] is given of some of the more common beneficial insects found in the United States, with notes on a few that have been introduced for biological control. They are dealt with under the headings of natural enemies of Aphids, parasites of Lepidopterous larvae and of white grubs, egg parasites, and polyphagous predators. Mention is also made of hyperparasites.

Ripley (L. B.) & Hepburn (G. A.). **Wild Host Plants for the Fruit-fly. Bug-tree and Bramble.**—*Fmg in S. Afr. 1935* reprint no. 28, 1 p. Pretoria, April 1935.

The common blackberry has recently been discovered to be a host-fruit of *Ceratitis* (*Pterandrus*) *rosa*, Ksh., in Natal. It is of less importance than *Solanum auriculatum* [*R.A.E.*, A **19** 167], however, as it does not constitute a winter breeding-ground for the fly.

Flanders (S. E.). **Two described Species of *Trichogramma* validated.**—*Pan-Pacif. Ent.* **11** no. 2 p. 79, 5 refs. San Francisco, Calif., April 1935.

The author considers that recent investigations have shown that *Trichogramma embryophagum*, Htg., and *T. semblidis*, Aur., have definite and distinct characteristics and are not synonymous with *T. evanescens*, Westw., which is the type of the genus and of which he believes *T. minutum*, Riley, to be a synonym. When they have been subjected to temperatures above 77°F., at least during the prepupal stage, the colour of the females of these three forms is strikingly different. At warm summer temperatures, therefore, *T. embryophagum* is clear yellow, *T. evanescens* is orange-yellow with fuscous markings, and *T. semblidis* is dilute fuscous with no trace of yellow [*cf. R.A.E.*, A **22** 361]. *T. pretiosum*, Riley, is considered a synonym of *T. embryophagum*.

Hough (W. S.). **Results of Experiments with Non-Arsenicals for Codling Moth Control.**—*Trans. Peninsula hort. Soc. 1934* pp. 12–14. Dover, Del. [1935.]

In investigations during 1934 in Virginia on substitutes for lead arsenate against the codling moth [*Cydia pomonella*, L.], natural cryolite (4 lb. per 100 U.S. gals. water) in 3 cover sprays, with the addition of 1 U.S. qt. fish oil in 2 of the sprays, applied in late June and through July, following lead arsenate in the calyx and 2 cover sprays in May and June, gave a control (12·7 per cent. injury by the larvae) equal to that given by lead arsenate through the season. Without fish oil the cryolite only reduced the injury to 27·6 per cent. After cryolite with or without fish oil in two July sprays, the fruit had to be washed in late October to remove excessive fluorine residues. Hydrochloric acid (1 and 1½ per cent.) was better for this purpose than sodium silicate (75 lb. per 100 U.S. gals.). Sprays of prepared nicotine bentonite only reduced the injury to 30–68 per cent.

A spray containing 1 lb. copper sulphate, 5 lb. Black-Leaf-155 [nicotine sulphate and bentonite], 3 lb. hydrated lime and 2 U.S. qts. Orthol-K emulsion (increased to 3 qts. in the last application) per 100 U.S. gals. was applied weekly from 29th May to 28th June. Early in July the injury was only 3 per cent. as compared with 6 per cent. on adjoining trees sprayed 3 times within the same period with lead arsenate. Although the nicotine killed most of the moths [*cf. R.A.E.*, A **23** 41] and the oil destroyed about 84 per cent. of the eggs, there was little or no insecticide remaining to prevent the entry of the young larvae that hatched between the sprays.

Stearns (L. A.). **An Examination of the Factors determining Spraying and other Recommendations for Control of the more important Insect Pests of Apple, Peach and Grape, during the Five-Year Period, 1930–1934.**—*Trans. Peninsula hort. Soc. 1934* pp. 30–44, 6 figs., 4 refs. Dover, Del. [1935.]

Most of the more important information in this paper on work in Delaware has already been noticed [*cf. R.A.E.*, A **19** 270; **21** 224, 227; **23** 321, 324; etc.].

Manns (T. F.) & Manns (M. M.). **Plums as Factors in the Dissemination of Yellows and Little Peach.**—*Trans. Peninsula hort. Soc. 1934* pp. 72–76, 3 figs. Dover, Del. [1935.]

The results of investigations on the part played by plums in the infection of peaches with yellows and little-peach in Delaware and adjacent States are briefly reviewed [*R.A.E.*, A **22** 298]. *Macropsis trimaculata*, Fitch, which has been shown to be the vector of both these virus diseases, occurs in all the States from Nebraska eastwards where peach is grown. During February–April, dormant branches of peach, plum, apricot and cherry from 12 different States were freed from adult insects and then covered with muslin to prevent the nymphs that hatched from migrating. It was thus found that the Jassid bred most on plums, the Japanese varieties (*Prunus salicina*) being more infested than the European or the American ones (*P. domestica* or *P. americana*). Peach and apricot originating from areas where no spraying was done were occasionally infested, but cherry was not. Oriental varieties of plum are capable of masking yellows and little-peach and of living for years after infection.

Farley (A. J.). **Observations on spraying Fruits in New Jersey.**—*Trans. Peninsula hort. Soc. 1934* pp. 132–136. Dover, Del. [1935.]

In this general survey of the difficulties in controlling insects and diseases of fruit trees by spraying, the author points out that better stickers are needed for lead arsenate, since in every orchard he examined there was less material in the upper part of sprayed trees after rain, while the quantity of insecticide at the bottom was greater or just the same. A schedule is given to show the latest dates on which lead arsenate may be applied to apples without danger of excessive lead and arsenic residues. These dates, which have been worked out for moderate and heavy spraying, vary according to the dates of the ripening of the fruit and the type of solution to be used in the washes [*cf. R.A.E.*, A **22** 299]. Notes are given on the use of spreaders, of which casein spreaders should not be used in association with oil and lead arsenate sprays, and on the amount of solids that can safely be used in these sprays [**22** 300].

McConnell (H. S.). **The Oriental Fruit Moth in Maryland.**—*Bull. Md agric. Exp. Sta.* no. 364 pp. 411–456, 3 diagrs., 8 pls., 22 refs. College Park, Md, June 1934. [Recd. June 1935.]

This bulletin includes a brief account of the history and bionomics of *Cydia* (*Grapholita*) *molesta*, Busck, in Maryland, where it causes particularly severe damage to peaches, apples [*cf. R.A.E.*, A **15** 262]

and quinces. Quince and apple are attacked late in the season after the beginning of the peach harvest by larvae of the fourth and the partial fifth generations, the infestation being apparently due to the migration of the moths. Apple suffers more when it is interplanted with or grown near peaches. The fruits of peach are damaged most by the larvae of the third brood during late July and August, as the first and some of the second brood larvae feed in the twigs. The following is taken from the author's summary: Applications of insecticides for the control of *C. molesta* have not proved to be worth while [*cf.* **20** 321]. Since many larvae overwinter in the soil or in rubbish beneath the trees, early cultivation helps to reduce the population during the next year. Measures to prevent moths from cocoons spun in packing houses and packing equipment from reaching the orchards are also useful. The principal parasites [*cf.* **20** 423] are *Macrocentrus ancylivorus*, Rohw., which attacks the larvae and is most effective when they are in twigs, and *Trichogramma minutum*, Riley, which attacks the eggs and is most effective late in the season. *M. delicatus*, Cress., and *Glypta rufiscutellaris*, Cress., are important in some localities.

Allen (H. W.) & Burrell (R. W.). **Methods of obtaining Emergence of *Tiphia* Adults from imported Cocoons for Use against the Japanese Beetle.**—*J. agric. Res.* **49** no. 10 pp. 909–922, 10 figs. Washington, D.C., November 1934. [Recd. June 1935.]

In ordinary insectary methods of rearing adults from cocoons of species of *Tiphia* brought to the United States for the control of *Popillia japonica*, Newm., mortality is extremely high in cocoons taken from their original cells and placed in soil, and it is not possible to ensure accurate regulation of temperature and humidity, on which high percentages of emergence depend. A new method has been adopted, in which test-tubes, each containing a cocoon, are placed on racks in trays stacked on shelves in an incubator constructed below ground level in order to regulate temperature and humidity more easily. The test-tubes are closed with stoppers of copper gauze. A thermostat enables the temperature in this cellar incubator to be kept at approximately the mean temperature of the soil at the depth where cocoons are usually found in nature. The temperature is changed at 15-day intervals, and the heat gradually increases from 35°F. in January and February to 76·3°F. in the latter half of July, and then decreases again until January. The relative humidity is maintained at approximately 90 per cent. by evaporation from water, which covers the floor of the incubator to a depth of about an inch. A second chamber in the incubator, where the temperature is kept 5° higher than in the first, is used for the species in which normal temperatures retard emergence. An electric fan connected to the thermostat provides ventilation, and the temperature of the incoming air is regulated by passing it over simmering water or cracked ice, a process that also brings it to approximately the required humidity.

By this method, the percentages of emergence in *T. pullivora*, A. & J., *T. popilliavora*, Rohw. (Chinese race), *T. vernalis*, Rohw., and *T. biseculata*, A. & J., increased from 0·1, 6·4, 5·4, and 13·7 to 24·9, 34·5, 12, and 61·1, respectively. With these species the time of emergence coincided satisfactorily with the time when they are best liberated. The emergence of *T. biseculata* was noticeably prolonged, and was divided into 2 distinct periods separated by a midsummer interval of

about 6 weeks. In preliminary tests 28·9 per cent. of *T. asericae*, A. & J., emerged, even though the trays containing the cocoons were transferred from the incubator to an outdoor insectary before emergence took place. With *T. antigenata*, A. & J., the emergence was 42·8 per cent. *T. bicarinata*, Cam., and *T. totopunctata*, A. & J., more hardy species, were not tested in cellar incubators, but when they were reared in wooden boxes containing soil in which cells were made by means of cross pieces of wood, the average percentage of emergence was 55·65 and 19·65. An emergence of 35·7 per cent. was obtained by the same method with *T. asericae*. A study of the reactions of *T. popilliavora*, *T. biseculata*, and *T. pullivora* to variations in treatment in the incubators show that small differences cause marked variations in the numbers of adults emerging. When test-tubes open at both ends were used, the emergence was 5 per cent. higher in *T. popilliavora* and 7 and 6 per cent. lower in *T. biseculata* and *T. pullivora* than when test-tubes open at one end were used. Spraying with water increased emergence of *T. popilliavora* by nearly 5 per cent., but reduced that of *T. biseculata* and *T. pullivora* by 14 and 23 per cent. respectively.

Jack (R. W.). **Annual Report for the Year 1933 : Entomological Branch. Agricultural.**—Fol., mimeographed, pp. 4–9. Salisbury, Agric. Lab. [1935.]

The number of adults of *Nomadacris septemfasciata*, Serv., that escaped the extensive campaign in Southern Rhodesia during 1932 [*cf. R.A.E.*, A **21** 672, 673] was augmented during May-November 1933 by stray ones from beyond the borders and in November by further large numbers entering from the north. The situation at the end of the year was so serious that all prospects of a general campaign to exterminate the hoppers had to be abandoned in favour of one designed to protect the main food crops [*cf.* **22** 702]. Unsuccessful attempts have been made to breed an important Tachinid parasite, the larvae of which feed in the fat-body of *Nomadacris* and sometimes destroy the reproductive organs. Flying swarms of *Nomadacris* attacked *Citrus* about the time of flowering and destroyed some young growth, blossoms and newly-set fruit, particularly at the tops of the trees. The results were not serious, however, since most of the damaged fruit dropped with the usual heavy fall of small fruit in October. Grapefruit and lemons were sometimes partly defoliated and appeared to be more attractive than oranges. After May, no swarms and no solitary individuals of *Locusta migratoria migratorioides*, R. & F., bred in the Colony though a few adults entered with *Nomadacris* in November. Probably the climate in Southern Rhodesia is unsuitable during the dry season.

Careful inspection of premises where tobacco is stored failed to disclose the presence of *Lasioderma serricorne*, F., and *Ephestia elutella*, Hb., appeared to be confined to one factory in the Salisbury district, though its occurrence in a country warehouse is suspected. Infestation by *Calandra oryzae*, L., of maize for export caused considerable inconvenience and financial loss. Primary infestation occurs in the field. The varieties grown for export are very susceptible and the climatic conditions under which most of them are grown are apparently favourable for the weevil's rapid development. *Plodia interpunctella*, Hb., has been found on several occasions in fresh imported chocolates ; in

most cases the infestation obviously originated overseas. *Heteronychus arator*, F., and *H. consimilis*, Klb., destroyed newly planted tobacco in November in one district and *Phthorimaea operculella*, Zell., and *P. heliopa*, Lw., were reported to have occurred sporadically. A local outbreak of *Brachytrypes membranaceus*, Drury, on tobacco seed beds was controlled by *Chlorion xanthocerum*, Ill. *Zenilla* (*Carcelia*) *evolans*, Wied., was reared from the overwintering larvae of *Busseola fusca*, Full., which was not very destructive to maize. *Tanymecus destructor*, Mshl., and *Mimaulus testudo*, Schönh., were prevalent in some areas and infested both seedling maize and tobacco. In one district, *Campsomeris coelebs*, Sich., attacked the larvae and pupae of *Eulepida mashona*, Arrow, which was more widely distributed on maize than had been thought. *Lyctus brunneus*, Steph., was found infesting the sapwood of eucalyptus (*Eucalyptus saligna*) used for making tobacco hogsheads. It had been introduced with the wood from Nyasaland. Heavily infested material was burned and the rest was treated for at least 8 hours at a temperature of 130–150°F. in a specially prepared kiln. Apparently all the larvae and pupae were destroyed. The Clerid, *Tarsostenus univittatus*, Rossi, was found with *Lyctus*, and is probably predacious on it.

Allan (W.). **The Movement and Breeding of Locust Swarm (July 1931–September 1932).**—*Ann. Bull. Dep. Agric. N. Rhod.* **2** (1932) pp. 25–34, 6 refs. Livingstone, 1933. [Recd. July 1935.]

A detailed account is given of the movements and breeding of *Locusta migratoria migratorioides*, R. & F., and *Nomadacris septemfasciata*, Serv., during the period from July 1931 to August 1932 in Northern Rhodesia, where both species undergo an imaginal diapause of about 9 months. From the study of monthly variations of humidity, in conjunction with maps showing the movements of *Locusta* swarms, it was found that the latter were generally confined to areas where the mean relative humidity was over 60 per cent. Within such areas the direction of flight was largely determined by the prevailing easterly winds, while the length, duration and height of flight appeared to be closely associated with temperature conditions, the swarm taking off only when the air temperature rose above 80°F. Particulars of the incubation and larval periods observed in both species are given, and an account of the daily behaviour of *Locusta* hoppers in dense and in sparse vegetation, which was in both cases determined mainly by temperature, their advance beginning when the ground temperature was about 82°F.

The usual control methods are discussed. Dusts of sodium arsenite were used, but spraying was found to be more practicable and economical in the long grass, as it required only a quarter of the amount of poison necessary for dusting. The spraying of grass around a group of hoppers caused up to 75 per cent. mortality.

Lewin (C. J.). **Locusts.**—*Rep. Dep. Agric. N. Rhod. 1934* pp. 14–16. Livingstone, 1935.

An account is given of the occurrence of *Nomadacris septemfasciata*, Serv., in Northern Rhodesia during the year 1934, towards the end of which the invasion reached its largest proportions. The hopper bands in the 1933–34 breeding season were smaller and more scattered

than in the previous year, and damage to crops was not extensive. The infestation of hoppers and young adults by the fungus, *Empusa grylli*, reached epidemic proportions, and most of the locally bred swarms perished. Later on, however, the Territory was again invaded, on a scale larger than before, by swarms that caused serious damage to grazing, and extensive egg-laying took place at the end of the year. The mature swarms were parasitised by Nematodes, by Dipterous larvae (? *Blaesoxipha* sp.), which caused great mortality, and by *Empusa grylli*, which in some places was responsible for wholesale destruction. The larvae of *Stomatorrhina lunata*, F., and of beetles of the genus *Mylabris* between them destroyed the majority of the eggs, so that the hopper outbreak was exceedingly small in comparison with the size of the parent swarms.

The hoppers and adults of *Locusta migratoria migratorioides*, R. & F, occurred in very small numbers, mixed with those of *Nomadacris*.

Les Acridiens au Tchad.—*Bull. Soc. Rech. congol.* no. 20 pp. 69–84. Brazzaville, 1935.

Locusts were present in the French Chad Territory in 1930, 1931 and 1932. An account is given of their movements in 1932 in the Chad Territory, Nigeria and the Gold Coast, as well as of the mechanical methods used for their control.

Haines (G. C.). **Cluster Bugs.**—*Fmg in S. Africa* 1935 reprint no. 27, 1 p. Pretoria, April 1935.

In South Africa various Pentatomids, of which *Agonoscelis versicolor*, F., *A. puberula*, Stål, *Piezodorus purus*, Stål, and *Nezara viridula*, L., are the most common, migrate every autumn from the veldt to seek winter quarters in sheltered places. They sometimes cluster on fruit trees and cause considerable damage to the tender twigs or fruit, and may also enter buildings in numbers. As a rule, they return to their natural food-plants in the veldt as soon as the weather becomes warm in spring. If fruit trees are infested, the bugs should be dislodged by jarring or washed off with a strong current of water, and should then be swept up and destroyed. They may also be killed by burning clumps of dry grass placed at the base of the tree, in which they will take shelter.

Myers (J. G.). **An Entomological Investigation in St. Vincent.**—*Trop. Agriculture* **12** no. 6 pp. 139–144, 5 refs. Trinidad, June 1935.

This record of a brief survey of St. Vincent is prefaced by an outline of general ecological conditions with particular reference to the introduction of natural enemies of the pests of the main crops.

About 48 per cent. of the stalks and 8 per cent. of the joints of sugar-cane were infested by *Diatraea saccharalis*, F., and *D. canella*, Hmpsn. These figures, which are low for the Lesser Antilles, would probably become greater if sugar-cane were grown on large estates. Seven wild grasses were also found to be infested, and *D. saccharalis* commonly attacks maize. The eggs of *Diatraea* are parasitised by *Trichogramma minutum*, Riley, and *Telenomus* (*Prophanurus*) *alecto*, Cwfd., which is the more abundant, and the larvae by *Microdus stigmaterus*, Cress. These are of little economic importance, and it

might be worth while to introduce *Lixophaga* [*diatraeae*, Tns.], *Paratheresia claripalpis*, Wulp, or *Metagonistylum* sp. (particularly one of the first two) against *D. saccharalis*.

In St. Vincent, the known parasites of *Calpodes ethlius*, Cram., on arrowroot [*cf. R.A.E.*, A **20** 674] include *Eucelatoria australis*, Tns., *Phorocera floridensis*, Tns., *Sarcophaga* sp., *S. lambens*, Wied., *Brachymeria annulata*, F., which is a new record obtained by C. K. Robinson, and *Apanteles* sp., which may be *A. talicida*, Wlkn. [*cf. loc. cit.*]. The most promising foreign parasites are *Achaetoneura nigripalpis*, Aldr., and *Exoristoides urichi*, Aldr. [**22** 568], which attack the larvae in Trinidad, and it is considered that if they are not already present in St. Vincent one or both should be introduced. Apart from these Tachinids the most noteworthy species is *Xenufens ruskini*, Gir., which destroys most of the eggs in Cuba. The alternative food-plants, which are important in connection with parasites, include cultivated and wild species of *Canna*. Parasites are less important than predators. The author attributes the widespread distribution and great abundance of *Polistes annularis*, L., in St. Vincent [*cf.* **22** 567] to the fact that since arrowroot is replanted at the time of harvest and *Calpodes* oviposits on the new leaves within 3 weeks of planting, there is a practically continuous supply of larvae throughout the year.

Infestation of cotton by *Dysdercus discolor*, Wlk. (*delauneyi*, Leth.), the chief pest, has been limited by close season regulations and the destruction of alternative food-plants. The abundance of trees of *Sterculia* (the destruction of which has been stopped owing to its economic impracticability), the presence of other food-plants that have been overlooked and possibly infringement of the close season and the seed-disposal regulations serve to maintain a fairly considerable population, which the author considers can only be reduced by biological means. In view of its efficiency against *Dysdercus* [*ruficollis*, L.] in Peru [*cf.* **21** 187], *Acaulona* [*peruviana*, Tns.] might be useful. The most important measure against *Platyedra* [*gossypiella*, Saund.] is a strict close season [*cf.* **22** 678]. Parasites could scarcely be introduced until some explanation is found of its extraordinary fluctuation in numbers in the West Indies from year to year and from island to island. *Aphis gossypii*, Glov., causes local damage, but Coccinellids appear to be plentiful and effective, particularly *Cycloneda sanguinea*, L., which is much more abundant than *Ceratomegilla* (*Megilla*) *maculata*, DeG.

Cosmopolites sordidus, Germ., is rare on bananas in St. Vincent.

The introduction of *Bufo marinus* is recommended, as it is of value against a variety of insect pests.

Box (H. E.). **West Indian Entomological Notes.**—*Trop. Agriculture* **12** no. 6 pp. 158–160. Trinidad, June 1935.

As the result of investigations of the status of *Lixophaga diatraeae*, Tns., in St. Lucia from August 1934 to January 1935 and in Antigua and St. Kitts during January–March, records are given of various local percentages of parasitism, which in general indicate its effectiveness against *Diatraea saccharalis*, F., on sugar-cane [*cf. R.A.E.*, A **23** 345]. *Lixophaga* could not be found in late February in the localities in Nevis into which it was introduced in 1934 [*loc. cit.*]. This is attributed to the fact that the cane areas are small, rather isolated and very scattered, with large intervening areas of wild coarse xerophytic

vegetation, but it is thought that these difficulties might be overcome by liberating consignments over several months. The average infestation of plant cane was 12·8 per cent. In March, *Lixophaga* was taken from St. Kitts to Montserrat. Damage caused to growing canes in Antigua by *Lachnosterna antiguae*, Arrow, was found to be due to the fields being inadequately drained. The larvae of *Lachnosterna* chew the roots of young plants and occasionally injure the rhizomes, but those of *Ligyrus tumulosus*, Burm., bore their way into planted cuttings, particularly in well-manured land. Both species (but especially the latter) are attacked by *Campsomeris dorsata*, F. In St. Kitts an unidentified mealybug destroyed about 2 acres of newly-planted canes, of which it infested the roots.

In Montserrat, limes are chiefly attacked by *Diaprepes* (*Exophthalmus*) *esuriens*, Gyll., *Coccus viridis*, Green, and *Pseudococcus citri*, Risso. *Pseudococcus* was present in practically every plantation in July 1934 (possibly owing to the relatively low rainfall of the previous season) and was extremely numerous on some of its alternative food-plants, including *Acalypha*. In March 1935, it was less noticeable, but it seemed to be increasing, particularly on limes and grapefruit, and was numerous on *Coccoloba uvifera*. It is of minor importance in Dominica and St. Lucia. About 500 individuals of *Cryptolaemus montrouzieri*, Muls. (most of them in the pupal stage) were sent in February from the Laboratory of the Imperial Institute of Entomology ; they were packed with potato shoots heavily infested with mealybugs. A total of 150 (including 120 adults) were recovered on their arrival at Montserrat after a journey that had been unavoidably prolonged to 32 days. Some of the Coccinellids were liberated on infested plants, but most of them were transferred to breeding cages containing an ample supply of *P. citri* feeding on aetoliated potato sprouts.

Dustan (G. G.). **The Influence of unfavourable Feeding Conditions on the Survival and Fecundity of Oriental Fruit Moths.**—*Canad. Ent.* **67** no. 5 pp. 89–90. Orillia, May 1935.

In connection with studies in Ontario in which the Oriental fruit moth [*Cydia molesta*, Busck] is reared in large numbers in the insectary on apples, an experiment was undertaken to determine the effect of feeding conditions on the size and fertility of the resulting moths. Apples 1 in. or less in diameter were divided into two lots and eggs placed on them at the rate of 2 and 10 per apple, respectively. One lot had 240 eggs on 120 apples with a total weight of 2 lb. 6 oz. and the other had 600 eggs on 60 apples with a total weight of 1 lb. 2 oz. No appreciable difference was observed in the length of the development of the various stages in the two lots. The total mortality from egg to adult was 10·8 and 47 per cent., respectively, the mortality of pupae 3·5 and 23·5 per cent., and the number of eggs laid per female 39 and 14·5. The average weight of a mature larva is about 0·0056 oz. When 2 eggs were used per apple the weight of the apples was about 32 times that of the larval weight of the moths that developed, which suggests that an apple 2½ ins. in diameter and 4 oz. in weight could permit the development of about 20 moths derived from 23 or 24 eggs.

In the field larvae rarely feed under crowded conditions either in the fruit or twigs, but under unfavourable conditions (such as dryness of the twigs or hardness or gumminess of the fruit), moths with a lower biotic potential might be produced.

Balch (R. E.). **Notes on the Habits of Attack of the Hemlock Borer.**—*Canad. Ent.* **67** no. 5 pp. 90–92, 5 refs. Orillia, May 1935.

As a result of an investigation of an outbreak of *Melanophila fulvoguttata*, Harr., on hemlock [*Tsuga*] in Nova Scotia during 1930–31, it is concluded that this Buprestid is unlikely to infest healthy timber and that it appears to confine its attack to seriously weakened or dying trees and to those that have been recently felled. Hemlock logs felled in the neighbourhood of Lake Rossignol and left unbarked became heavily infested during the summer, and the beetles emerged from them in large numbers. During each of the following two years the level of the lake was raised. Heavy infestation occurred on those trees that had had their roots submerged for a month or more ; it was evident from other trees that these would in any case have been killed by the water. No record was obtained of successful attack above this level, even in trees that were decadent and stagheaded. It seemed improbable that the beetles were controlled to such an extent by natural factors that they were not sufficiently numerous to attack the living trees, though larvae were killed by woodpeckers and a Braconid of the genus *Coeloides*, and some of those situated within 1–2 ft. of the water level died, evidently owing to the effect of the water on conditions in the bark. It appeared more probable that the beetles were unable to attack living trees successfully, particularly as in the few attacks observed the larvae died young.

Unbarked logs and some of the larger tops with sufficiently thick bark appeared to provide very favourable conditions for the beetle. Stumps were not generally favourable, owing to the amount of moisture forced up into them from the roots. The larvae were more numerous in parts of logs exposed to the sun, and there was no evidence that they were killed by high subcortical temperatures.

Putman (W. L.). **Notes on the Hosts and Parasites of some Lepidopterous Larvae.**—*Canad. Ent.* **67** no. 5 pp. 105–109, 1 ref. Orillia, May 1935.

A list, showing their food-plants and parasites, is given of numerous species of Lepidoptera that were reared in the Niagara Peninsula, Ontario, during an investigation of the native hosts of the parasites of *Cydia* (*Grapholitha*) *molesta*, Busck, the economic results of which have already been noticed [*R.A.E.*, A **23** 372].

Chandler (S. C.) & Flint (W. P.). **Insect Enemies of the Peach in Illinois.**—*Circ. Ill. nat. Hist. Surv.* no. 26, 38 pp., 30 figs., 5 refs. Urbana, May 1935.

A popular account is given of about 20 species of insects that attack peach trees in Illinois and of methods of controlling them, including notes on the preparation of the necessary insecticides.

Cory (E. N.) & Langford (G. S.). **Sulfated Alcohols in Insecticides.**—*J. econ. Ent.* **28** no. 2 pp. 257–260. Geneva, N.Y., April 1935.

These studies were made with four commercial types of sulphated alcohols. They contained the following percentages of the active ingredients : sodium lauryl sulphate, 50 per cent. ; sodium octadecyl

sulphate, 60 per cent.; sodium oleyl sulphate, 28 per cent.; and sodium oleyl sulphate special, 45 per cent.

A dipping test with *Melanoplus femur-rubrum*, DeG., showed that all the materials had some toxicity. Sodium lauryl sulphate and sodium oleyl sulphate special were the most toxic, and compared favourably with neutral potassium coconut fatty acid soap. The same rating prevailed when emulsifying and wetting properties were considered.

At a dilution of 1 per cent. of the commercial product, a spray of sodium lauryl sulphate killed 92–98·2 per cent. of the cabbage aphis [*Brevicoryne brassicae*, L.], and one of sodium oleyl sulphate special killed 92·1 per cent. Some kinds of plants were not affected by these sprays, but others were injured by much lower concentrations.

The value of sulphated alcohols as carriers for other insecticides are shown by tests in which they were added to nicotine sulphate or solutions containing 0·02 per cent. pyrethrins. Thus nicotine sulphate (1 : 1,000) killed 17·5 per cent. of *B. brassicae*, and the same spray with the addition of sodium oleyl sulphate special (0·06 per cent.) killed 99·3 per cent. Mortalities of 100 per cent. of the Mexican mealybug [*Phenacoccus gossypii*, Tns. & Ckll.] were obtained with pyrethrins to which sodium oleyl sulphate special and sodium lauryl sulphate (0·5 per cent. in each case) had been added, whereas the pyrethrins alone gave 33·3 per cent. mortality. The addition of 0·01 per cent. pyrethrins to a 0·12 per cent. solution of sodium lauryl sulphate, in which grasshoppers were dipped for 10 seconds, increased the average kill from either of the solutions alone from 10 per cent. to 66·6 per cent. Nicotine sulphate (1 : 500) alone killed 10 per cent. of box elder bugs [*Leptocoris trivittatus*, Say] dipped for 5 seconds; with the addition of sodium lauryl sulphate (0·25 per cent.) it killed 75 per cent.; and sodium lauryl sulphate (0·25 per cent.) alone gave no mortality.

Data from 79 tests on *Culex pipiens*, L., showed that both sodium lauryl sulphate and sodium oleyl sulphate special at a dilution of the products equivalent to 0·5 per cent. of the active ingredients are decidedly toxic to mosquito larvae. When used at the same rate in aqueous solutions of pyrethrins at rates of 1 part to 1 million and 1 part to 5 million, sodium lauryl sulphate increased the speed of action nearly 4 times. Sodium oleyl sulphate special in similar tests in addition pyrethrins up to 1 part to 1 million showed an increase in the speed of action of about 2½ times. The sodium sulphate that occurs in the commercial products did not exhibit any toxicity in 34 minutes.

All the materials tested may be used as emulsifying agents for petroleum oils, pine oils and carbon bisulphide. In general the emulsifying properties of the several compounds, which are discussed, are rated as follows: Sodium lauryl sulphate, sodium oleyl sulphate special, sodium oleyl sulphate and sodium octadecyl sulphate. As wetting agents sodium lauryl sulphate and sodium oleyl sulphate special appear to give promise. Excellent wetting has been obtained on cabbage with a 0·06 per cent. concentration of the active ingredient of the materials. A wettable sulphur is made by mixing 1 part by weight of sodium lauryl sulphate with 100 parts by weight of sulphur. All of the sulphated alcohols appear to be compatible with lime-sulphur and lead arsenate.

Because of its detergent properties in cold water and its emulsifying properties, sodium lauryl sulphate was tested for washing fruit for

the removal of lead arsenate residues. When 1 lb. of the compound was used with 100 U.S. gals. cold water containing 1 per cent. hydrochloric acid, 86–89 per cent. of the lead and 85–89 per cent. of the arsenic was removed, whereas the acid solution alone removed 63–75 per cent. of the lead and 63–70 per cent. of the arsenic.

Farrar (M. D.) & Kelley (V. W.). **The accumulative Effect of Oil Sprays on Apple Trees.**—*J. econ. Ent.* **28** no. 2 pp. 260–263. Geneva, N.Y., April 1935.

The following is the authors' summary of tests in Illinois : Dormant oil sprays applied over 5 and 10 year periods to relatively young apple trees did not affect tree growth measurably under orchard conditions. An application of 8 per cent. dormant oil has consistently delayed bud opening on all varieties for 3–7 days. Concentrations of 2 and 3 per cent. have occasionally caused a slight retardation for 2–3 days.

Summer applications of an unsaturated oil of 32 seconds viscosity did not injure either fruit or foliage. An 83 second viscosity unsaturated oil injured both fruit and foliage. The saturated oils gave little to no injury when applied in 3 sprays of 2 per cent. concentrations between 25th June and 15th August. The growth of apple trees receiving three sprays of summer oil was not measurably different from the untreated controls.

Hartzell (F. Z.), Harman (S. W.) & Reed (T. W.). **Some recent Developments in Regard to Tar Distillate and Tar-lubricating Oil Sprays.**—*J. econ. Ent.* **28** no. 2 pp. 263–268. Geneva, N.Y., April 1935.

Observations are recorded on the effect of dormant sprays on fruit trees subjected to extreme winter temperatures in New York State in 1933–34. When applied in spring, lubricating oil and tar oil at the same concentrations produced about the same effects on the crop, but in autumn treatments the lubricating oils were more injurious to the wood and also decreased the crop more. Mixtures of the two oils appear to be more toxic to weak trees than either oil alone when the total oil content is the same. On trees severely weakened by the winter, lubricating oil and tar oil used at strengths necessary for the control of San José scale [*Aspidiotus perniciosus*, Comst.] or rosy apple aphis [*Anuraphis roseus*, Baker], respectively, appeared to cause considerable injury to the trees and to the set of fruit. On moderately weakened trees, both oils proved reasonably safe provided that the concentration did not exceed 3 per cent. and the spray did not contain a mixture of the two. Winter-hardy trees were uninjured by spring applications of either or both oils provided that the total oil content did not exceed 5 per cent.

Autumn treatment with emulsions containing approximately 65 per cent. tar distillate and 15 per cent. lubricating oil on moderately vigorous and vigorous trees seemed to cause less injury to the limbs and set of fruit than did spring applications, provided that the total oil content did not exceed 4 per cent. At higher concentrations the autumn and spring treatments produced practically the same effects.

The standards desirable for tar distillates and lubricating oils are set out and discussed. It is suggested that manufacturers should

make three preparations (one of each oil, and one a mixture) that could be mixed in any required proportion without breaking of the emulsions. The mixture should contain the tar distillate and the lubricating oil in the ratio of 2·4 to 3 for use against both *A. perniciosus* and *A. roseus*.

CARTER (W.). **Diesel Oil Emulsions as Insecticides.**—*J. econ. Ent.* **28** no. 2 pp. 268–284, 6 figs., 4 refs. Geneva, N.Y., April 1935.

Details are given of the characteristics and preparation as insecticides of emulsions of Diesel fuel oils, and of experiments made on their emulsification, together with briefer notes on tests in which they were successfully used in Hawaii against *Pseudococcus brevipes*, Ckll., on pineapple and several species of Coccids on *Citrus* and ornamental shrubs [*cf. R.A.E.*, A **22** 698].

The following is taken from the author's summary: Colloidal clays, principally bentonite, have been used and emulsions of 10 or 15 lb. bentonite, 10 U.S. gals. oil and 10 U.S. gals. water proved stable. Bentonites from various sources differ materially in their reaction to emulsification with Diesel oil. No correlation has been found between a crude gel test and emulsifying properties. The method of agitation used in emulsification has some bearing on the smoothness and homogeneity of the resulting emulsion. Homogeneity and stability of concentrated emulsions can be improved by increasing the amount of bentonite, by the addition of certain salts and by blood albumen.

The safe use of the oil as an insecticide is affected by such factors as the type of bentonite, the method of emulsification, and particularly the dispersal of the oil-charged bentonite particles. Dispersal phenomena are not apparently dependent on pH, since there is no correlation between the pH of solutions of salts used in the spray water and dispersal. In addition it has been shown that blood albumen, a neutral compound with colloidal characteristics, can be used to get dispersal.

An extensive study of leaf injury in pineapple has shown that the anatomy of the plant ensures the accumulation of a ring of concentrated emulsion on the leaf surface, and when leaf spotting occurs it is at that point. Increasing the amount of bentonite in the emulsion and the concentration of salts in the spray water has practically eliminated this leaf spotting. Other plants, such as *Citrus* and ornamental shrubs, have been sprayed without injury with much higher concentrations than can be safely used on pineapples. *P. brevipes* on pineapple has been controlled with 1 per cent. sprays. Several species of scale insects on *Citrus* and ornamental plants have been controlled with concentrations of from 1 to 4 per cent.

JONES (H. A.), CAMPBELL (F. L.) & SULLIVAN (W. N.). **Relations between chemical Composition and insecticidal Effectiveness of Rotenone-bearing Plants.**—*J. econ. Ent.* **28** no. 2 pp. 285–292, 1 fig., 6 refs. Geneva, N.Y., April 1935.

The following is substantially the authors' summary: The results of tests of the toxicity to house-flies [*Musca domestica*, L.] of extracts of 6 samples of derris root, 5 samples of cubé root, 1 sample of haiari stem and 1 sample of root of *Tephrosia* (*Cracca*) *virginiana* were compared with the values obtained for these samples by certain

chemical determinations. The amount of rotenone in the samples was too low to account for all the toxicity. In more than half of the samples the figures by the Gross-Smith test [*R.A.E.*, A **22** 727], considered as representing the sum of rotenone and deguelin, agreed with the toxicity value, but in the other samples they were lower. Total-extractive values were higher than toxicity, and values based on the methoxyl content of the extract were somewhat closer but were also too high. When an approximate value for toxicarol was subtracted from the methoxyl figures, the results agreed more closely with the toxicity figures in general than did the results of other determinations. However, it is impossible, on the basis of the present results, to recommend unreservedly any one of these chemical determinations as a measure of insecticidal effectiveness of rotenone-bearing plants. Further work, particularly a more thorough study of the individual constituents in such plant materials, is needed on this subject.

Ginsburg (J. M.) & Granett (P.). **Arsenical Substitutes. I. Chemicals tested as Arsenical Substitutes in 1934.**—*J. econ. Ent.* **28** no. 2 pp. 292–298, 18 refs. Geneva, N.Y., April 1935.

Experiments were conducted with several groups of chemicals by the following method: One part of the chemical, whether liquid or powder, was mixed with 19 parts of an inert carrier, such as talc. The dust mixture was sifted on to both sides of a leaf until it was uniformly covered and the excess was then shaken off. Larvae of *Bombyx mori*, L., were placed on leaves thus treated. When a chemical showed appreciable toxicity, it was again tested on the same insect in dust and spray form at various concentrations. If the results corroborated the preliminary test, more extensive experiments on other chewing insects were conducted in the laboratory or field. In the preliminary tests the toxicity of the chemicals was compared with that of a dust mixture containing 5 per cent. lead arsenate and 95 per cent. inert carrier. This mixture kills 80 per cent. or more of the third instar larvae of *B. mori* within 48 hours.

The results of the tests, which are given in tables, are summarised as follows: Of the 74 organic chemicals tested, pentachlorophenol, cinchonine, nicotine tannate and diphenyl guanidine possessed high toxicity to the larvae of *B. mori*; methoxy quinoline, diphenyl guanidine, ico-quinoline and O-nitroanisol were distinctly repellent to them. Of the 13 inorganic chemicals, cadmium oxide and cadmium hydroxide proved highly toxic to larvae of *B. mori* and *Malacosoma americana*, F., and to adults of *Tribolium confusum*, Duv., but showed no toxicity to larvae of *Popillia japonica*, Newm. On plants pentachlorophenol produced injury in high dilutions, whereas the two cadmium salts produced injury to certain plants in concentrations of 0·5 per cent. or higher and no noticeable injury to any plant tested at concentrations of 0·25 per cent. or lower.

List (G. M.). & Sweetman (L.). **The Collection and Analysis of Data on the Value of non-arsenical Insecticides for the Control of Cabbage Worms.**—*J. econ. Ent.* **28** no. 2 pp. 298–304, 3 refs. Geneva, N.Y., April 1935.

Details are given of experiments carried out against *Pieris* (*Ascia*) *rapae*, L., on cabbage in Colorado to illustrate a method of paired

comparisons for determining the relative values of insecticides, making allowance for the standard error. The value of each insecticide was estimated by ascertaining the mean initial population and mean mortality on each of 20 plots before and after treatment, and calculating the standard error. Differences in mortality obtained with different insecticides were only considered significant if they were considerable after allowing for the standard error.

DIETZ (H. F.) & ZEISERT (E. E.). **The Performance of certain inorganic Insecticide Dusts in the Control of Cucumber Beetles.**—*J. econ. Ent.* **28** no. 2 pp. 310–314, 1 fig. Geneva, N.Y., April 1935.

An investigation was carried out in Ohio to test the reliability of several indirect methods (*i.e.*, methods other than counts of reduction in insect population) of evaluating the efficiency of insecticide dusts in the control of *Diabrotica melanocephala*, F. (*vittata*, F.) and *D. duodecimpunctata*, Ol., on cucumber. Nine applications were made between 21st June and 23rd July, and population counts were made before and after each. Two measurements of vine growth were taken, one following the sixth application, the other just before picking time.

The results show that the highest average vine growth, the largest number of fruits, the greatest weight of fruit and the lowest incidence of bacterial wilt in no case occurred simultaneously after the same treatment. The incidence of wilt in any given treatment was the most consistent measure of insecticidal efficiency and the average vine growth the least. It is concluded that the growth and yield of plants may be influenced by factors quite distinct from freedom from insect attack. Neither weight nor number of fruits is a measure of insecticidal efficiency unless supported by evidence of a more direct nature. The variations between indirect methods are great enough to invalidate the use of any one of them alone, and several must be considered collectively. Direct measurements, no matter how inadequate they may seem, should be taken and the results compared with those obtained by indirect methods. When the results of a number of methods are considered collectively, several treatments may group themselves as among the best, any one of which would give satisfactory commercial control.

PARKER (J. R.). **The 1934 Grasshopper Control Campaign.**—*J. econ. Ent.* **28** no. 2 pp. 314–323, 4 refs. Geneva, N.Y., April 1935.

The most extensive grasshopper campaign ever conducted in the United States was carried out by the Department of Agriculture with the co-operation of 18 western States in 1934, when for the first time the outbreak had been accurately predicted and all details planned in advance. The general features of the campaign, including its organisation and finance, the activities preliminary to the application of baits, their production and shipment, the control operations, which began as soon as the eggs hatched, and the value of the crops saved, are discussed. The total amount of bait estimated to be necessary for all States was 75,175 tons and 74,637 tons was actually used. The campaign again demonstrated the value of poisoned bran mash,

and showed that when its application is properly organised it affords a means of complete control over an entire region, as it has previously done in individual States and smaller areas.

DAVIS (J. J.). **The European Corn Borer : Past, Present and Future.** —*J. econ. Ent.* **28** no. 2 pp. 324–333. Geneva, N.Y., April 1935.

In this survey of methods of controlling the European corn borer [*Pyrausta nubilalis*, Hb.], its history in Canada and the United States, its present status and the probable trend of work to come are dealt with. Current measures reviewed include agricultural practices, the development of resistant strains of maize, insecticides, quarantine, and the utilisation of parasites, of which *Angitia* (*Inareolata*) *punctoria*, Rom., and *Lydella stabulans grisescens*, R.-D. (the Tachinid commonly called *Ceromasia* (*Masicera*) *senilis*, Mg.), out of 20 introduced species, have become established in the United States and show definite possibilities for control.

FLINT (W. P.). **The Chinch Bug.**—*J. econ. Ent.* **28** no. 2 pp. 333–341, 7 refs. Geneva, N.Y., April 1935.

The history, bionomics and control of the chinch bug [*Blissus leucopterus*, Say], at present the most destructive pest of maize in the United States, are briefly reviewed from the literature of the last 50 years and the future development of the problem is discussed.

READIO (P. A.). **The Entomological Phases of the Dutch Elm Disease.** —*J. econ. Ent.* **28** no. 2 pp. 341–353, 2 figs., 44 refs. Geneva, N.Y., April 1935.

A brief sketch is given of the history of Dutch elm disease in Europe and of the way in which it was probably introduced into the United States. An analysis of present records shows that it was probably introduced in at least 6 separate areas, of which the only one where infestation by *Scolytus multistriatus*, Marsh., had previously occurred and where the infection spread to any extent was that comprising New York, New Jersey and Connecticut. The author points out that necessarily true inferences on the rate at which the disease has spread [*cf. R.A.E.*, A **23** 328] cannot be drawn merely from the discovery of infested trees. *Ceratostomella* (*Graphium*) *ulmi* has been found in the 1926 growth ring of a tree discovered to be infected only this year in Indianapolis and in rings of one, two or three seasons past of trees located this year in New York. Estimates of the numbers and percentages of infested trees are quoted.

The relation of Scolytids and other beetles to the disease [*cf.* **22** 649, 652 ; **23** 319] is discussed. Data compiled from an investigation of the New York State College during the past season show that of the infected trees examined, 67·4 per cent. were infested by *S. multistriatus*, 54·4 per cent. by *Eutetrapha* (*Saperda*) *tridentata*, Ol., and 10·9 per cent. by *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh. Brief notes are given on the stages and bionomics of *S. multistriatus* and on the methods of control employed in Europe [**22** 339] and in America [**22** 392]. The Siberian elm (*Ulmus pumila*) is the species most resistant to the disease of those hitherto studied.

Breakey (E. P.) & Miller (A. C.). **A Method for comparing the Ovicidal Properties of Contact Insecticides.**—*J. econ. Ent.* **28** no. 2 pp. 353–358, 1 ref. Geneva, N.Y., April 1935.

The procedure followed in sterilising the eggs of blowflies [*cf. R.A.E.*, B **20** 125] served as a basis for an attempt made in Ohio to develop a standard method of comparing the ovicidal efficiency of substances commonly used as contact insecticides. The technique is explained in some detail. In addition to the eggs of blowflies, those of *Sitotroga cerealella*, Ol., *Ephestia kühniella*, Zell., and *Pseudococcus citri*, Risso, were used in the tests. A lot of 400–500 eggs is poured into a test tube about ¾ full of the diluted insecticide from a paper trough in which they are placed to facilitate handling. The test tube is then closed and gently shaken. The eggs and fluid are poured on to a filter paper placed in a Büchner funnel, and the fluid is drawn away by a pump. The filter paper is then placed on a dry filter paper in a petri dish. The whole of this procedure takes 10–15 seconds. In treating the controls, water is substituted for the insecticide. The petri dishes, in which humidity is maintained by spraying the insides of the covers with water, are kept at a temperature not exceeding 75–80°F. The counts are made at the end of the incubation period.

Breakey (E. P.) & Miller (A. C.). **Halowax as an Ovicide.**—*J. econ. Ent.* **28** no. 2 pp. 358–365, 11 figs., 2 refs. Geneva, N.Y., April 1935.

The technique explained in the preceding paper was applied to an attempt to compare the ovicidal properties of Halowax, a chlorinated naphthalene [*cf. R.A.E.*, A **22** 403], with those of common contact insecticides. About 80,000 eggs of *Sitotroga cerealella*, Ol., 95 per cent. of which were about 48 hours old, 100,000 of *Phormia regina*, Mg., and 25,000 of *Ephestia kühniella*, Zell., were used.

The concentrations of 40 per cent. basic nicotine and 40 per cent. nicotine sulphate required to kill all the eggs of *Sitotroga* were 1 : 750 and 1 : 700, respectively. Undiluted 40 per cent. nicotine sulphate killed only 85 per cent. of the eggs of *Phormia*, but 40 per cent. basic nicotine at a concentration of 1 in 12·5 destroyed them all. Petroleum oil (80 per cent. viscosity and 90+ sulphonation value) at a concentration of 1 in 100 killed 85 per cent. of the eggs of *Sitotroga* and *Ephestia*, but, like undiluted Nujol and a miscible dormant spray oil diluted with an equal amount of water, had no effect on the eggs of *Phormia*. Pyrethrins (extract in alcohol assaying 3·375 gm. per 100 cc.) at a concentration of 1 in 5,000 killed nearly 95 per cent. and over 90 per cent. of the eggs of *Sitotroga* and *Phormia*, respectively. Emulsions containing 1 part rotenone (prepared from an extract of derris in pine oil assaying 5 gm. rotenone per 100 cc.), 19 parts pine oil, 5 parts saponin and 75 parts of water, killed 95 per cent. of the eggs of *Sitotroga* at a concentration of 1 in 50,000, but a concentration of 1 in 5,000 was required to kill 98 per cent. of the eggs of the blowfly. Suspensions of rotenone prepared from an extract of derris in acetone and tannic acid gave confirmatory results. An emulsion of Halowax with equal parts of the petroleum oil already tested, diluted to give a concentration of 1 part Halowax to 10,500 parts spray, killed all eggs of *Sitotroga*, while an emulsion of Halowax alone (the emulsifier being the same as in the emulsion of Halowax and oil) killed 94 per cent. at a concentration of 1 in 8,000. The first emulsion (1 part

Halowax to 20,000 parts spray) killed all the eggs of *Ephestia*, and the second (1 : 15,000) killed over 90 per cent. All the eggs of the blowfly were killed by the combined emulsion at a concentration of 1 : 12,000, and by Halowax alone with a concentration of 1 : 6,000. Of the toxic substances studied Halowax showed the least tendency to vary in its effects.

FROST (S. W.). **1934 Notes on Baits for Oriental Fruit Moth.**—*J. econ. Ent.* **28** no. 2 pp. 366–369. Geneva, N.Y., April 1935.

Forty different chemicals were tested as baits for *Cydia molesta*, Busck, in Pennsylvania. In each test 10 tin traps of about 1 U.S. gal. capacity, each containing baits of syrup and water (1 : 20) with the addition of 1 gm. of the chemical in an emulsion, were placed on alternate trees of alternate rows in an orchard of peach and apple. Screens of $\frac{1}{4}$ and $\frac{1}{2}$ inch mesh over the tops of the traps materially reduced the catch of *C. molesta* and failed to eliminate Noctuids and Cetoniids of the genus *Euphoria*. Baffles appeared rather to reduce than to increase the catch of *C. molesta* [*cf. R.A.E.*, A **23** 53], but increased the numbers of Cetoniids and Noctuids. Although they did not catch so many moths as the large enamel traps [*loc. cit.*] or as glass traps, the aluminium coated tin traps are both light and easy to keep clean. The best of the materials, in descending order, were linaool, safrol, propyl acetate, amyl acetate, anethol, terpinyl acetate and furfural. All these were definitely attractive, but safrol is the most satisfactory, since linaool is too expensive.

NEISWANDER (R. B.). **Variations in seasonal Prevalence of Oriental Fruit Moth Adults in Peach and Quince Orchards.**—*J. econ. Ent.* **28** no. 2 pp. 369–371, 1 fig., 1 ref. Geneva, N.Y., April 1935.

Records from bait traps placed in peach and quince orchards in Ohio over the period 1930–34 showed that adults of the oriental peach moth [*Cydia molesta*, Busck] tend to become more numerous on peach than on quince during the early part of the season and to become more numerous again on quince as the quinces get more suitable for larval feeding. Consequently more larvae go into hibernation on or near quince trees. From these data it may be inferred either that quince foliage becomes more attractive for oviposition as the summer passes or that larval mortality on quince trees is very high during early summer.

MONTGOMERY (B. E.). **Notes on the Biology and the developmental Stages of *Glypta rufiscutellaris*, Cress. (Ichneumonidae, Hymenoptera) a larval Parasite of the Oriental Fruit Moth.**—*J. econ. Ent.* **28** no. 2 pp. 371–376, 2 figs. Geneva, N.Y., April 1935.

The technique used in studies undertaken in New Jersey during 1930 on the immature stages of *Glypta rufiscutellaris*, Cress., an important parasite of *Cydia* (*Grapholitha*) *molesta*, Busck, is fully described. The egg and the four larval instars are described and figured. The parasites were allowed to oviposit in cages containing larvae of *Cydia* in peach twigs. The larval stages were determined by dissecting parasitised host larvae at various times, none of which were later than the 21st day after the parasites had oviposited. Larvae 1, 2, 3 and 4 days old when exposed to the parasites showed 80,

53, 38 and 16 per cent. parasitism, respectively. Eggs of *Glypta* were found in the host until the 6th day after oviposition, larvae in the 1st instar from the 6th to the 15th day, in the 2nd and 3rd instars from the 12th and 13th days, respectively, to the 20th day, and in the 4th instar in the host from the 19th to the 21st day and in the cocoon from the 20th day. The only case of superparasitism observed was in a larva dissected on the 6th day after the parasite had oviposited. It contained an egg and a larva. Parasite larvae were found in a few host larvae that had been exposed only to unfertilised females.

CHAPMAN (P. J.) & DEAN (R. W.). **Larvicidal Efficiency of certain Spray Combinations against the Fruit Tree Leafroller.**—*J. econ. Ent.* **28** no. 2 pp. 376–379. Geneva, N.Y., April 1935.

In New York State, various spray combinations were tested against the larvae of *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., against which, in acute infestations, lead arsenate and other larvicides had given poor results. About 17 U.S. gals. spray per tree was applied on heavily infested apple trees on 5th May 1934 just before blossoming, and 21 U.S. gals. on 14th May after the blossoms had fallen. The most effective spray, which gave satisfactory control, was a combination of 6 lb. lead arsenate, 1 U.S. gal. summer oil, 1 U.S. qt. nicotine sulphate, and 3 lb. Coposil (a powdered form of copper ammonium silicate, in 100 U.S. gals. water. The moderate russeting it caused on some fruits should probably be attributed to the copper in the fungicide. Sprays containing nicotine in various forms gave only partial control.

The data obtained suggest that newly hatched larvae of *T. argyrospila* are readily poisoned by lead arsenate, provided that adequate coverage is maintained throughout the hatching period. The required type of coverage seems to be better effected by summer oil emulsions than by casein or similar spreaders, though the oil itself does not seem to have any insecticidal action. The egg masses hatched naturally, and although no plot received summer oil alone, the results obtained with nicotine sulphate, with and without oil, suggest that the oil had little, if any, larvicidal value.

REED (T. W.). **The Biology of the Apple Aphids in Relation to Fall Spraying.**—*J. econ. Ent.* **28** no. 2 pp. 379–385, 1 fig. Geneva, N.Y., April 1935.

In the autumn of 1929 a study of *Aphis pomi*, DeG., *Anuraphis roseus*, Baker, and *Rhopalosiphum prunifoliae*, Fitch, on apple was begun in New York State. It was found that the autumn activities of these Aphids are independent of each other and that the relative abundance of each species varies considerably from year to year. The eggs of *A. pomi* were found only on young water sprouts and on young trees in the vicinity of late surviving colonies of the summer forms. *R. prunifoliae* oviposited principally on the smaller branches in exposed situations and *A. roseus* on the larger branches in the vicinity of fruit spurs, in cracks and under rough bark where the eggs are not readily observed. The oviparous females of *A. roseus* withstood a temperature of 10°F. but succumbed at 7°F. Oviposition and other activity of this species and *A. pomi* only occurred at temperatures above about 40°F.

Control experiments were mainly directed against *A. roseus*, the most destructive of the 3 Aphids. Defoliating the trees by sprays of sodium nitrate or sodium arsenite in September prevented the winged migrants from depositing their young. A repetition of this experiment during 1930 later in the autumn when oviparous females were present was equally successful, but caused too much injury to the twigs and branches. Sprays of mineral oil and 40 per cent. nicotine sulphate (16 : 1 : 800) were fatal to the Aphids, but could not be well applied. Mixed emulsions of tar oil (65 per cent.) and lubricating oil (15 per cent.) applied at a concentration of 5 per cent. in autumn and spring during 1931–33 gave almost complete control and caused no injury to the trees, but even weaker concentrations caused serious injury in autumn and spring sprays during 1933–34 when the winter was very severe. A combination of mineral oil (1½ per cent.) and cresylic acid (½ per cent.) applied in the autumn of 1933 caused very severe injury. Higher concentrations applied in the following spring were also injurious.

Steiner (H. M.). **Immediate and residual Effects of certain Insecticides on the White Apple Leafhopper.**—*J. econ. Ent.* **28** no. 2 pp. 385–388. Geneva, N.Y., April 1935.

Tests to determine the residual effects of many spray combinations used as single treatments against second brood nymphs of *Typhlocyba pomaria*, McAtee, were conducted during 1934 in the Hudson Valley (New York State) on heavily infested apple trees 7–10 years old. Applications were made during the peak of hatching (22nd–25th August). The reduction after 24 hours was called the immediate kill and the difference between the number of nymphs developing on sprayed and unsprayed trees during the 120 hours following the first count was called the residual kill. Pyrethrum extract in penetrol gave no residual kill. Almost all the other sprays contained nicotine sulphate and the best results were given when it was used at the rate of 1 : 1,200 with various soaps. The immediate and residual kills varied with the soap used from 99·5 and 27·1 per cent. to 100 and 96 per cent. Although the eggs were apparently unaffected by nicotine sulphate in combination with soaps and oils, the nymphs were sometimes killed in the process of hatching. Where the water is hard, oil emulsions would need to be substituted for soaps. In further laboratory tests, when foliage was treated with spray mixtures and the percentage of kill recorded after 24 hours, ⅔ U.S. pint nicotine sulphate alone in 100 U.S. gals. water was not so effective as when it was used with ½ lb. or 1 lb. soap, but more effective than when it was used with 3 lb. soap. This result confirmed those of the field tests. The inference that the high residual kill was due to the persistence of nicotine on the foliage was confirmed by analysis.

Hutson (R.). **Strawberry Leaf Roller Control by non-poisonous Insecticides.**—*J. econ. Ent.* **28** no. 2 pp. 388–390. Geneva, N.Y., April 1935.

In Michigan, intensive cultivation of perpetual strawberries during May, June and July produces luxurious growth on which the population of *Ancylis comptana*, Froehl., is built up to a maximum by about 1st August when harvesting is in progress, and the entire crop is often destroyed. The common practice of spraying with lead arsenate just

before and after blossoming is objectionable for perpetual strawberries because of residues, and local conditions of moisture, wind and soil do not favour burning over as an alternative. In tests in June 1933 with a number of non-arsenical dusts and sprays, dusts of pyrethrum and derris gave the best results. These dusts, applied when the second brood were active, reduced the population by 75 per cent. and this was sufficient to render the leaf-roller unimportant for the rest of the season. They also have the advantage that they can be used to stop an attack while the fruit is ripening. A spray of ground derris and soap was about as good, but pyrethrum sprays with and without spreading agents were not so satisfactory.

Felt (E. P.). **The important Shade Tree Insects in 1934.**—*J. econ. Ent.* **28** no. 2 pp. 390–393. Geneva, N.Y., April 1935.

One of the worst pests of shade trees in the north-eastern United States [*cf. R.A.E.*, A **22** 285, etc.] during 1934 was *Alsophila pometaria*, Harr., which, after extensive localised injury in the preceding season [*loc. cit.*], caused severe damage, particularly to ash, black walnut [*Juglans nigra*] and hickory. Evidence that the larvae, which hatch over some weeks, drift with the wind accounts for the occasional defoliation of banded trees. *Paleacrita vernata*, Peck (spring cankerworm), though less generally abundant than *A. pometaria*, may have been the dominant species in a few localities. *Malacosoma americana*, F., was extremely abundant, but confined itself mainly to the relatively worthless wild cherry, and was in most cases readily controlled on fruit trees by spraying. *M. disstria*, Hb., was locally abundant in New Hampshire, Massachusetts and Connecticut. Numerous oaks in New York and on Long Island were attacked by *Agrilus bilineatus*, Web., which destroyed 25 per cent. of the trees in some stands weakened by the drought of 1930–32 and defoliation by leafrollers. It is most effectively controlled by spraying [with lead arsenate, *cf. loc. cit.*] in late May or early June to kill the beetles, and by stimulating the growth of the trees, as healthy trees are rarely attacked. In south-eastern New York *Cyllene robiniae*, Forst., has damaged many young trees [*Robinia pseudacacia*]. *Glycobius speciosus*, Say, caused general injury to sugar maples [*Acer saccharum*] in Vermont and New Hampshire. Elms attacked by *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.), which continued to be abundant [*cf. loc. cit.*] are susceptible to infestation by *Scolytus multistriatus*, Marsh. *Cryptococcus fagi*, Bär., which is associated with *Nectria coccinea* [*loc. cit.*], is becoming more widely established on beech. The unchecked activity of *Plagiodera versicolora*, Laich [*cf.* **21** 316], supplemented by the recently introduced willow scab fungus, killed thousands of willows. *Pissodes approximatus*, Hopk., which bores in the bark of the trunk, especially below the surface, killed several transplanted pines in Connecticut. After their extreme abundance on Long Island in 1933, there was a high mortality in the spring of 1934 among *Leucodiaspis* (*Leucaspis*) *japonica*, Ckll., and *Aspidiotus perniciosus*, Comst. [*cf.* **22** 411] as the result of extremely low temperatures during the preceding winter.

Underhill (G. W.). **The Pecan Tree Borer in Dogwood.**—*J. econ. Ent.* **28** no. 2 pp. 393–396, 2 refs. Geneva, N.Y., April 1935.

A severe infestation of dogwood [*Cornus* sp.] by *Aegeria* (*Synanthedon*) *scitula*, Harr., the adult and larva of which are described,

occurred in Virginia in 1931. Since this borer first attracted attention as a pest of pecan in 1904, it has been recorded from a number of trees, and has been confused with other species, including *A. pyri*, Harr., in apple and pear. Its range appears to extend from Florida to Canada and from Illinois to Mississippi. In Virginia it is generally distributed on dogwood, of which it infests the cambium, but is neither common nor abundant on native trees. Young dogwood trees are chiefly attacked at the crown, but the rough bark of older ones may be infested. Particulars of the extent of infestation during 1931–33 are given.

The larvae overwinter in the burrows. By the middle of May 20–30 per cent. are usually in their cocoons, which are generally found in rubbish beneath the trees, and 15–20 per cent. have pupated. No pupae have been collected after 1st October. The prepupal and pupal stages averaged 6·6 and 12·4 days respectively. Moths emerge from mid-May till the end of September, maximum emergence occurring in June and July. They lived in cages for up to 18 days, with an average of 9 days for females and 7 for males. In captivity, the maximum number of eggs deposited by one female was 116 and most were sterile. The incubation period for the only two lots of eggs hatching in 1934, about the middle of July, was 8–9 days. Larvae, which are present throughout the year, tunnel upward in the bark and cambium in an irregular spiral. The life-cycle of most of the borers is completed in one year. According to measurements of head capsules there are 6 instars. Up to 50 per cent. of the larvae have been observed to be parasitised by *Apanteles sesiae*, Vier. Only one larva develops from a host ; it emerges to spin a cocoon in a cell previously prepared by the latter. In the case of *Microbracon sanninoideae*, Gah., and *M. mellitor*, Say, which are much less common, more than one parasite develops from the host larva. Several individuals of *Phaeogenes ater*, Cress., and one of *Pimpla* (*Scambus*) *conquistor*, Say, were reared from pupae collected in May and June. Numbers of the Eulophid, *Hyssopus sanninoideae*, Gir., emerged from about 6 borer cocoons.

BROWER (A. E.). **Control Measures for the Arbor Vitae Leaf Miners, especially** *Recurvaria thujaëlla* **(Lepidoptera).**—*J. econ. Ent.* **28** no. 2 pp. 397–398, 6 refs. Geneva, N.Y., April 1935.

Leaf-miners known to attack arbor-vitae [*Thuja occidentalis*] in the United States are *Argyresthia thuiella*, Pack., which is generally the most common and injurious, *A. freyella*, Wlsm. [*R.A.E.*, A **21** 510] and *Recurvaria thujaëlla*, Kf. In collections from parts of Maine, however, *R. thujaëlla* was the most numerous, with smaller numbers of *A. thuiella* and an occasional individual of *A. freyella*. The moths emerge in June and July. The eggs are laid on the growing tips, which are entered by the larvae $\frac{1}{4}$–$\frac{1}{2}$ inch from the end. The terminal and mined portions die and turn brown. Larval mining continues until cold weather and is resumed in the spring. In 1933 a series of sprays (chiefly nicotine sulphate) were tested immediately after the flight periods. Laboratory emergence and field collections in 1934 showed that the main emergence period in central Maine is 21st June–6th July for *A. thuiella*, and 9th–25th July for *R. thujaëlla*, whereas emergence of *A. freyella* covers both these periods. The average incubation period for both *A. thuiella* and *R. thujaëlla* is probably about 20 days. Various sprays were applied on 10th August, of which only nicotine sulphate was effective. Counts made between 15th September and

15th October 1934 showed that following its application at strengths of 1 : 1,000 and 1 : 400, with the addition of penetrol at the rate of 1 : 200, 91·09 and 99·27 per cent. of the larvae were dead as compared with 12·64 per cent. in the controls. All eggs are apparently killed by strong nicotine sprays. Clipping the hedges and destroying the clippings is a good supplementary measure. A preponderance of *A. thuiella* might make an earlier spray necessary.

RICHARDSON (H. H.). **A Progress Report on the insecticidal Control of the Mexican Mealybug** (*Phenacoccus gossypii* **T. and Ckll.) on Greenhouse Chrysanthemums.**—*J. econ. Ent.* **28** no. 2 pp. 399–405, 12 refs. Geneva, N.Y., April 1935.

The following is mainly taken from the author's summary : *Phenacoccus gossypii*, Tns. & Ckll., has become widely dispersed in the United States and sometimes destroys 40–50 per cent. of the chrysanthemums in greenhouses. Derris, pyrethrum and tobacco dusts failed to control it. Sulphur dusts killed 82·2 per cent. of the eggs but had little effect on the nymphs and adults. Of the sprays tested soap, nicotine, pyrethrum and derris were less effective than organic thiocyanates or kerosene emulsion. The best of the thiocyanates exerted a residual toxic action for several days after spraying and killed 82 per cent. of the eggs and 88·1 per cent. of the adults and nymphs. A 10 per cent. kerosene emulsion killed 97·3 per cent. of the adults and nymphs but only 44·7 per cent. of the eggs. Ordinary kerosene (43·4°Bé.) was more effective than a highly refined lighter kerosene (48·6°Bé.). The effectiveness of kerosene emulsion did not differ much at 25, 100, 200 or 300 lb. pressure. Practical tests showed the 10 per cent. emulsion to be effective, and it was tolerated by a wide variety of chrysanthemums. Hot water dips and naphthalene or nicotine fumigations were practically useless. *Phenacoccus gossypii* was much more susceptible to calcium cyanide fumigation than was *Pseudococcus citri*, Risso, or *P. maritimus*, Ehrh. Overnight exposures to dosages of $\frac{3}{16}$–$\frac{1}{2}$ oz. per 1,000 cu. ft. (depending on the air-tightness of the greenhouse) killed 5–15 per cent. of the eggs, and $\frac{7}{16}$–$\frac{1}{2}$ oz. gave high mortalities among the adults and nymphs. Good control was secured with 3–6 fumigations at weekly intervals. Stock plants, rooted and unrooted cuttings, growing plants, and plants in bloom were fumigated with little or no injury. Calcium cyanide fumigation is much more suitable from the standpoint of thoroughness, efficiency, cost and ease of application than a spray.

NEISWANDER (C. R.). **Experiments in the Control of two Greenhouse Mealybugs,** *Phenacoccus gossypii* **T. & Ckll. and** *Pseudococcus citri* **Risso.**—*J. econ. Ent.* **28** no. 2 pp. 405–410, 2 figs., 1 ref. Geneva, N.Y., April 1935.

After an outbreak of *Phenacoccus gossypii*, Tns. & Ckll., on greenhouse chrysanthemums in Ohio in the autumn of 1933, preliminary tests of various insecticides were carried out by spraying infested twigs or leaves. An aliphatic thiocyanate, Lethane No. 420, was significantly superior to all the other materials used, a combination of Lethane 1 : 400 and penetrol 1 : 200 producing an average mortality of 91 per cent. Experiments in commercial greenhouses with this material, at varying strengths and in combination with penetrol and with soap,

confirmed these results, though slight scorching was caused to certain varieties. Mortality was not materially reduced when the concentration of the insecticide or the amount of the spreader was halved. Similar results have been secured by Murphy and Peet with *Pseudococcus citri*, Risso [*R.A.E.*, A **21** 566]. In a test with the eggs of *Phenacoccus gossypii*, 93–99 per cent. mortality was secured. In tests made on *Pseudococcus citri* infesting *Coleus*, Lethane No. 420 (1 : 800), when used with soap (1 : 250), gave practically the same kill (99 per cent.) as nicotine sulphate (1 : 400) with Verdol (1 : 200), although in tests with *Phenacoccus gossypii* the latter combination in the same proportions was considerably inferior to Lethane (1 : 800). A spray (1 : 200) of a commercial preparation containing 0·75 per cent. rotenone and 1·8 per cent. pyrethrins gave a kill of 74 per cent.

Flint (W. P.), Farrar (M. D.) & McCauley (W. E.). **Chinch Bug Barriers and Repellents.**—*J. econ. Ent.* **28** no. 2 pp. 410–414, 1 fig., 2 refs. Geneva, N.Y., April 1935.

Tests of mechanical barriers and repellents used against chinch bugs [*Blissus leucopterus*, Say] were carried out under normal field conditions in Illinois in 1934. The technique of the experiments is described. Designs of successful mechanical barriers of metal or paper, all of which require creosote or some other repellent to maintain their efficiency, are shown. Tar paper or corrugated paper should be cut in strips 4 inches wide, dipped in the repellent and set 2 inches deep in the soil with the corrugations vertical. Earthen ridge barriers, when well constructed and maintained, are efficient and dependable, except when high winds carry the bugs over the creosote line. The volatilisation of repellent odours from creosote seems to be reduced if the viscosity is in excess of 90 seconds Saybolt. Furthermore the very heavy oils, although relatively efficient, are so viscous that they tend to run downwards during applications. Oils below 42 seconds Saybolt are not so efficient as oils between 42 and 90 seconds over periods of more than 24 hours between renewals. The lighter oils apparently penetrate the soil too rapidly or are volatilised too quickly by soil temperatures. The viscosities of several creosotes widely used in 1933 are shown, and lists are given of unsatisfactory materials and of materials that are valuable only for one or two days. Metal barriers are not only expensive but require some material such as free oil, saturated burlap, earth or felt to maintain the repellent on their surface, and have to be treated at least once a week.

Huber (L. L.) & Houser (J. S.). **A Comparison of certain Materials used as Chinch Bug Barriers.**—*J. econ. Ent.* **28** no. 2 pp. 414–416, 1 fig., 2 refs. Geneva, N.Y., April 1935.

An investigation was carried out under normal field conditions in Ohio to compare the effectiveness of 4 materials used by farmers as barriers against the chinch bug [*Blissus leucopterus*, Say] in 1934. The technique of the experiments is described. The data showed that there were great differences between two of the materials, both of which were water gas tars, but are rendered inconclusive by the fact that these by-products are too variable to give consistent results. The authors suggest that present recommendations go beyond the limits of actual knowledge.

Claassen (P. W.) & Palm (C. E.). **The Alfalfa Snout Beetle, *Brachyrhinus ligustici* L., a new Insect Pest in New York State.**—*J. econ. Ent.* **28** no. 2 pp. 417–420. Geneva, N.Y., April 1935.

A note on the distribution of *Otiorrhynchus* (*Brachyrrhinus*) *ligustici*, L., in Europe is followed by details of an investigation into its life-history and behaviour in the United States where it has recently become established in New York State along the southern and eastern shores of Lake Ontario [*cf. R.A.E.*, A **21** 476] and has caused considerable injury to lucerne [**23** 380]. The first adults were seen in 1934 on 9th May, and on 21st August a female still containing eggs was found. The species is parthenogenetic. The adults cannot fly, but they crawl over considerable distances. After a brief period of inactivity they feed on various plants. In addition to lucerne and clover, rhubarb, strawberries and raspberries were sometimes completely defoliated, and grape-vines, apple and asparagus were also attacked. The eggs are placed round lucerne plants not more than 2 inches below the surface of the soil. The oviposition period for 40 individuals averaged 38·7 days and the number of eggs varied from 125 to 515. The first egg was deposited on 31st May and the last ones on 20th July. On an average the beetles lived 48·9 days after beginning to oviposit. In the laboratory about 60 per cent. of the eggs hatched and the average incubation period at 68–75°F. varied from 15 to 22 days. The activity of the beetles and the rate of oviposition is closely related to temperature, but few of the eggs laid at 85°F. or more hatched, though the incubation period was much shorter at higher than at lower temperatures.

The newly hatched larvae feed at first in the crowns of the lucerne plants but soon burrow down to the root, where they prune off the side roots and mine in the tap root, which they eventually cut off. In severely infested fields, 200 larvae per cu. ft. of soil were found. They are most numerous in the upper 10 ins. of the soil but severed roots have been found 28 ins. below the surface. The larvae also feed on the roots of clover and other plants. They have seven instars. They overwinter in cells from 3 to 26 ins. below the surface of the soil, and pupate in late spring or early summer. The normal pupal period is 21–25 days. The newly transformed adults remain inactive in the soil for the rest of the summer, and hibernate, emerging in the following spring to complete a 2-year cycle. Evidence that as many adults will emerge in 1935 as during 1934 suggests that alternate cycles have become established. Although little has been done towards control, spraying with arsenicals in the field killed many of the adults after they had emerged from the soil. Trenches caught large numbers of migrating weevils and barriers of naphthalene checked migrations.

Seamans (H. L.) & McMillan (E.). **The Effect of Food Plants on the Development of the Pale Western Cutworm (*Agrotis orthogonia* Morr.).**—*J. econ. Ent.* **28** no. 2 pp. 421–425. Geneva, N.Y., April 1935.

In Canada, where it occurs throughout the Great Plains, *Porosagrotis* (*Agrotis*) *orthogonia*, Morr. (pale western cutworm) is practically

omnivorous. Stinkweed (*Thlapsi arvense*) and veined dock (*Rumex venosus*), however, are eaten only sparingly even in the absence of other food-plants. A study was carried out in 1933 and 1934 to determine what rate of development, sex survival and mortality was to be expected in a field when the original crop had been destroyed and only other plants are available for food. The technique of preliminary experiments, in which the larvae were reared in the laboratory [*cf. R.A.E.*, A **16** 266], is described.

Of larvae fed on wandering Jew (*Tradescantia* sp.) 85 per cent. died and all the pupae were deformed. Among larvae fed on wet stubble, pigweed (*Chenopodium album*) and stinkweed, respectively, 84, 59 and 51 per cent. died. Feeding on Russian thistle (*Salsola pestifer*), sugar-beets and Canadian thistle (*Cirsium arvense*) produced larval mortalities of 34·5, 32 and 30 per cent., respectively. Larval mortalities of 23–21 per cent. were caused by feeding on dandelion, lucerne, sweet clover, winter wheat and barley, whereas the mortality among larvae fed on spring wheat, grass, oats and winter rye in no case exceeded 19 per cent. Of larvae starved for 17 days before being fed on wheat until full-grown only 31·6 per cent. died. Consequently, once a crop of wheat has been destroyed it might be best to leave the field unseeded and so force the larvae to feed on pigweed, Russian thistle or rotting stubble.

The most rapid development occurred among larvae fed on cereals, grass and lucerne, and the greatest lag in development occurred when wandering Jew, pigweed, Canada thistle and Russian thistle were used. Other plants and decaying stubble came between these extremes.

Larvae collected from the field in the prepupal stage produced about equal numbers of males and females. Larvae that had been starved or fed on spring wheat, oats, barley, rye, wandering Jew or sugar-beets produced more female than male pupae, whereas the reverse was the case with those fed on lucerne, sweet clover, grass, winter wheat, Russian thistle, Canada thistle, pigweed and stinkweed. Few pupae, equally divided among the sexes, were produced by larvae fed on wet stubble. The sex ratio for adults was the opposite to that for the pupae when the larvae had been fed on lucerne, grass, Russian thistle, pigweed, Canada thistle, stinkweed or wandering Jew. Sixty per cent. of the pupae that succumbed were males. The inference is that either the males lacked sufficient vitality to emerge or the females lacked the necessary vitality to pupate. An infestation sufficient to destroy 85 per cent. of a re-seeded crop of wheat only destroyed 52 per cent. or less of barley seeded at the same time.

The common Tachinid parasites, *Linnaemyia* (*Bonnetia*) *comta*, Fall., and *Gonia* spp., appear to prefer to deposit their eggs or larvae on grasses or cereals. Average parasitism by these species when the material was collected was estimated at 35–40 per cent. in 1934. The percentages of parasitism among larvae fed on winter wheat, oats, grass, Canada thistle, spring wheat, sugar-beets, dandelion, Russian thistle, lucerne, sweet clover, barley and stinkweed were 58, 54, 50, 50, 48, 47, 40, 40, 39, 38, 36 and 34, respectively. There was 49·5 per cent. parasitism in the check series of larvae, which had finished feeding when they were collected. The comparatively low parasitism among larvae that had been starved (13·1 per cent.) or fed on pigweed (31 per cent.) or wet stubble (7 per cent.) is considered to indicate that many parasitised larvae and their parasites died before pupation.

Seamans (H. L.). **Forecasting Outbreaks of the Pale Western Cutworm (*Agrotis orthogonia* Morr.).**—*J. econ. Ent.* **28** no. 2 pp. 425–428, 2 refs. Geneva, N.Y., April 1935.

To make easier the control of *Porosagrotis* (*Agrotis*) *orthogonia*, Morr., by cultural practices designed to prevent the moths from ovipositing in certain fields during August and early September, outbreaks have been successfully forecast in Alberta since 1923 [*cf. R.A.E.*, A **11** 459; **17** 98, etc.], and later in Saskatchewan. Forecasts are based on the fact that cutworms come to the surface if 0·25 inches of rain falls in one day or if the soil is wet enough to make it hard to use a disk harrow. Forecasts are more accurate if wet days are recorded separately from those on which the disk harrow cannot be used. The method developed in Montana on the basis of total precipitation for May, June and July [**14** 124] has proved less satisfactory in Canada. Forecasts for the past 11 years are briefly reviewed.

McMillan (E.). **A Survey of Cutworm Damage in a Specimen Locality in Saskatchewan.**—*J. econ. Ent.* **28** no. 2 pp. 428–431. Geneva, N.Y., April 1935.

The most widespread loss to cereal crops ever recorded in Western Canada was caused between 1927 and 1933 by *Porosagrotis* (*Agrotis*) *orthogonia*, Morr. In order to obtain accurate data concerning the actual percentage of loss caused by this cutworm, a survey, the methods of which are described, was carried out in September and October 1931 in two areas where the outbreak had been most extensive and severe, and where wind damage was not great enough to falsify the estimate. The gross loss on 23,909 acres was estimated at about £6,400, or, including farm operating costs, over 25*s.* an acre. During 1929–1932 about 3,000,000 acres were infested by the cutworm.

List (G. M.). **Psyllid Yellows of Tomatoes and Control of the Psyllid, *Paratrioza cockerelli* Sulc, by the Use of Sulphur.**—*J. econ. Ent.* **28** no. 2 pp. 431–436, 3 figs., 5 refs. Geneva, N.Y., April 1935.

Information is given on the control of *Paratrioza cockerelli*, Šulc, on tomatos in Colorado. The symptoms and effects of the psyllid yellows caused by the feeding of the nymphs are described. Plants freed from the Psyllid by means of a lime-sulphur spray (1 : 50) or sulphur dusts (200 mesh) [*R.A.E.*, A **23** 95] usually recover. Those receiving one spray showed an increased yield over the controls of 24,171 lb. per acre, those receiving 2 sprays 27,465 lb., and those receiving 3 sprays 37,536 lb. Corresponding figures for plants that had received one, two and three applications of dusts were 14,726, 9,500 and 10,126 lb.

Moore (J. B.). **Studies of the Reactions of Potato Aphids to sprayed and unsprayed Potato Leaves.**—*J. econ. Ent.* **28** no. 2 pp. 436–442, 5 figs., 11 refs. Geneva, N.Y., April 1935.

Various workers have observed that the numbers of *Macrosiphum solanifolii*, Ashm., tend to increase on potatoes that have been sprayed with Bordeaux mixture [*cf. R.A.E.*, A **18** 221]. An experiment in New York proved that there is no greater increase among Aphids allowed to develop on sprayed plants than among those developing

on unsprayed plants under greenhouse conditions. A second experiment, the technique of which is described, showed that the Aphids were definitely attracted by the light reflected by sprayed as compared with unsprayed leaves. Spectral analysis showed that there was no difference in the wave-lengths of light reflected from sprayed and unsprayed potato leaves but that light reflected from the surface of sprayed leaves was more intense. Again, a plate made of the transmitted light showed that more of the longer wave-lengths are absorbed by the sprayed leaves, so that there is probably a slight difference in temperature at the leaf surface. In a preliminary field experiment conducted during the summer of 1934 there were far less Aphids present on plants sprayed with Bordeaux mixture combined with a fast green dye than on those sprayed with Bordeaux mixture alone, but there were yet fewer on unsprayed plants.

DeLong (D. M.) & Caldwell (J. S.). **Hibernation Studies of the Potato Leafhopper (*Empoasca fabae* Harris) and related Species of *Empoasca* occurring in Ohio.**—*J. econ. Ent.* **28** no. 2 pp. 442–444, 2 refs. Geneva, N.Y., April 1935.

All attempts to discover where *Empoasca fabae*, Harr., hibernates have hitherto failed [*cf. R.A.E.*, A **20** 137], though a large number of other much less numerous species of *Empoasca* have been found in various habitats in Ohio during January, February, March and April. The earliest adults of *E. fabae* appear at the end of May or beginning of June, at least a month later than the date at which other common leafhoppers emerge from hibernation [*loc. cit.*]. *E. erigeron*, DeLong, and *E. bifurcata*, DeLong, which are known to overwinter in the egg stage, are easily found in the nymphal stage on wild food-plants in the spring, but nymphs of *E. fabae*, although this species is much more numerous, have never been found on similar plants. Examination of crop remnants failed to give any positive evidence for the supposition that the eggs overwinter. The author considers that the late appearance of *E. fabae*, the abrupt appearance of large numbers late in the season in cultivated fields, a phenomenon characteristic of other migrating leafhoppers, and the failure to discover hibernating forms in Ohio are evidence for the theory that this species survives the winter only in milder climates and subsequently migrates in the adult stage to Ohio and other northern States. He adds that material from Florida and the Gulf of Mexico proves that *E. fabae* breeds there on lucerne and similar crops during the winter and that it produces large populations in March and April.

Howard (N. F.), Brannon (L. W.) & Mason (H. C.). **Derris and other Insecticides for the Control of the Mexican Bean Beetle.**—*J. econ. Ent.* **28** no. 2 pp. 444–448, 2 refs. Geneva, N.Y., April 1935.

In continuation in 1933 and 1934 of studies of various insecticides used for the control of *Epilachna corrupta*, Muls., begun several years ago in Ohio and Virginia [*R.A.E.*, A **21** 239], experiments with derris were carried out on various kinds of beans. Infestation was very heavy in Ohio during both years and in Virginia during 1934. Very good control was obtained with 2–2½ lb. derris (4·4 per cent. rotenone) in 50 U.S. gals. water. This spray gave

better control and better residual effect than derris dusts. A spray of 1 lb. derris in 50 U.S. gals. water was toxic to insects present on the leaves but had little residual effect. Water suspensions of ground derris were superior to extracts of derris or pyrethrum and to a combination of the two. They were more effective alone than with the addition of soap. Dusts of ground derris root mixed with a carrier to give a rotenone content of from 0·5 to 0·75 per cent., applied at the rate of 20–25 lb. per acre, gave very good results. Talc was the best of the 6 carriers tested. Commercial derris dusts containing from 0·45 to 0·55 per cent. rotenone gave as satisfactory results as the home mixtures of the same rotenone content. Among the other substances tested, sprays (all at 3 lb. to 50 U.S. gals. water) of cryolite, thiodiphenylamine and cuprous cyanide gave good results and did not injure the foliage. Sulphur, as a dust or as a spray (8 lb. to 50 U.S. gals. water) was not toxic enough to give consistently good control of the Coccinellid, but is useful in protecting the foliage against Jassids and mites. Sprays of barium fluosilicate and magnesium arsenate gave fairly good control, but injured the foliage. Results obtained with dusts and extracts of pyrethrum, dusts and sprays of nicotine, and sprays of potassium hexafluoaluminate and anabasine sulphate were poor.

MENUSAN, jr. (H.). **Effects of constant Light, Temperature and Humidity on the Rate and total Amount of Oviposition of the Bean Weevil,** *Bruchus obtectus* **Say.**—*J. econ. Ent.* **28** no. 2 pp. 448–453, 3 figs., 3 refs. Geneva, N.Y., April 1935.

The following is taken from the author's summary of experiments carried out in New York State to determine some of the factors affecting the oviposition of *Bruchus obtectus*, Say, on beans. Constant white light reduced the number of eggs deposited and the reduction was proportional to the intensity of the light. Temperature had a marked effect on the rate of oviposition. The length of the oviposition period increased as constant temperatures decreased from 40 to 13°C. [104 to 55·4°F.]. The greatest number of eggs was deposited at 24°C. [75·2°F.], whereas the highest rate of egg deposition was at 27°C. [80·6°F.]. Few eggs were laid at 40°F. and none at 8·7°C. [46·4°F.]. The humidity of the environment did not appreciably affect the time required for oviposition. The greatest number of eggs was deposited at 90 per cent. relative humidity. At low humidities (1–25 per cent.) fewer eggs were laid than at higher humidities.

SLEESMAN (J. P.). **Ovicidal Tests on certain Dipterous Eggs—with especial Reference to the Onion Maggot,** *Hylemia antiqua* **Meig.**—*J. econ. Ent.* **28** no. 2 pp. 453–457. Geneva, N.Y., April 1935.

The following is substantially the author's summary of experiments carried out during the past 3 years in Ohio. Lubricating oil emulsions, used alone and in combination with Bordeaux mixture (4 : 6 : 50), are not toxic to the eggs of *Hylemia antiqua*, Mg., *Tritoxa flexa*, Wied., or *Sarcophaga sternodontis*, Tns. (*sarraceniae*, Riley). Increasing the concentration of oil from 2 to 6 per cent. did not increase the toxicity. Immersing the eggs of *T. flexa* and *S. sternodontis* in undiluted lubricating oil for periods of up to 60 minutes did not lower the rate of hatching.

Houser (J. S.). **The Black Grain-Stem Sawfly, *Trachelus tabidus* (Fab.), in Ohio.**—*J. econ. Ent.* **28** no. 2 pp. 457–458. Geneva, N.Y., April 1935.

Most of this information on the discovery in 1934 of *Trachelus tabidus*, F., infesting wheat and occasionally rye in Ohio has already been noticed [*R.A.E.*, A **23** 20]. The better wheat was invariably more heavily infested, and it appears that the earliest, most sturdy straws are selected for oviposition. Infestation reached 52 per cent. in wheat that had been protected by snow and was consequently more vigorous, whereas it only reached 22 per cent. in adjacent unprotected wheat.

Davis (A. C.) & Young (H. D.). **Sulphur Fumigation for the Control of Mushroom Pests.**—*J. econ. Ent.* **28** no. 2 pp. 459–465, 2 figs. Geneva, N.Y., April 1935.

Fumigations were carried out during 1933 and 1934 in commercial mushroom houses in Pennsylvania and in a fumigation chamber in Virginia to ascertain the minimum concentrations of sulphur dioxide necessary to give complete control of all mushroom insects and mites exposed to it at different temperatures. The apparatus and methods used in the experiments are described. The insects used were adults and larvae of *Lepidocyrtus lanuginosus*, Gmel., and all stages of *Sciara* sp., and the mites were *Tyroglyphus lintneri*, Osb., and *Histiostoma* sp.

The following are substantially the authors' summary and conclusions: At 120°F. and 90 per cent. relative humidity in the fumigation chamber, fumigations with gas concentrations having a maximum of about 6 mg. per litre, with a mean of about 3·8 mg., and requiring about 65 minutes to drop to 1·5 mg. seem to be close to lethal. Fumigations at maximum concentrations of 6 mg. or more, with mean concentrations of approximately 3·8 or 3·9 mg. and requiring 80–90 minutes or more to drop to 1·5 mg. should give complete kill of all insects and mites exposed. In the fumigation chamber at 100°F. and approximately 90 per cent. humidity, which represents as nearly as possible the conditions along the floor of the average mushroom house during the period of peak heat, concentrations having maxima of 14·7 and 10 mg., means of 7·22 and 6·11 mg., and requiring 92 and 95 minutes, respectively, to drop to 1·5 mg. per litre gave less than 0·02 per cent. survival. At this temperature a concentration having a maximum of 12 and a mean of 8 mg. or more and requiring 110 minutes or more to drop to 1·5 mg. should give complete kill of all insects and mites exposed.

In mushroom houses that are empty or off bearing, at a temperature of 70–80°F. and 80–90 per cent. relative humidity, fumigations reaching a maximum gas concentration of 10 mg. or more, with a mean concentration of 5 mg. or more and requiring 200 minutes to drop to 1·5 mg. should give complete kill of all insects and mites exposed. These concentrations are easily reached with the use of the outside sulphur burner, burning flowers of sulphur at the rate of 2 lb. per 1,000 cu. ft. of air space.

In mushroom houses at peak heat it is difficult, if not impossible, to get a concentration sufficiently high to be of great value by burning sulphur within the house at the allowed dosage of 2 lb. per 1,000 cu. ft.

of air space. This is true to a less extent even with the outside sulphur burner. The concentrations necessary for complete control along the cooler floor are the ones to be considered, since these are greater than those necessary at the higher temperatures found in the upper part of the house. Comparison of concentrations necessary for 100 per cent. kill at 100°F. in the fumigation chamber with those obtained in mushroom houses at peak heat show that the latter are too low to give a complete kill along the floor level. However, with fumigation at sufficiently high concentration, the rate of survival of insects and mites will be rather low.

Compton (C. C.). **Factors relating to the Control of the Mushroom Mite,** *Histiostoma gracilipes* **Banks.**—*J. econ. Ent.* **28** no. 2 pp. 465–468. Geneva, N.Y., April 1935.

Chortoglyphus (*Histiostoma*) *gracilipes*, Banks, has caused losses in excess of £6,000 annually during the past 3 years to one mushroom grower alone in Illinois, where it is more generally destructive than either *Tyroglyphus lintneri*, Osb., or *Linapodes motatorius*, L. (*antennaepes*, Banks). The more important points in mushroom culture are briefly outlined. The occurrence of the hypopus stage in *C. gracilipes* is responsible for the damage it causes. It emerges from this stage within 24 hours in the presence of free water and temperatures of 75–90°F. The hypopial nymphs are more resistant to fumigants than other stages, but as they always transform into active mites before the maximum heat is reached, fumigation at this time need not be of greater strength than that required to kill the feeding stage. The feeding and quiescent stages of the mite require about one-half the concentration of hydrocyanic acid gas necessary to kill the hypopi. The ventral surface of the hypopus is provided with suckers by which it is attached to various insects infesting the mushroom beds. The greatest injury is effected during the first few weeks following spawning, when the moist condition of the beds and temperature level provide conditions under which one female may produce 8,000,000 offspring within a month. All the active stages of the mite injure the spawn by feeding on and cutting off the strands of mycelium. They also feed on the fruiting caps, a type of injury more characteristic of *T. lintneri*.

Control measures consist of cleaning the empty mushroom house by burning sulphur at the rate of 2–3 lb. to 1,000 cu. ft. before the fresh compost is introduced, removing old compost at least a mile from the house and a like distance from new compost, which, however, may still contain mites, fumigation with sodium cyanide (5 oz. to 1,000 cu. ft.) or calcium cyanide (10 oz. Cyanogas to 1,000 cu. ft.) for 24 hours, when any mites in the newly introduced compost are driven out at the time of final heating, and flooding the floor with water at a temperature of 180°F. or a spray consisting of 2½ U.S. gals. miscible oil and 1 lb. lye to 50 U.S. gals. water, in order to kill any mites that are on the floor and so escape fumigation. To prevent the entrance of insects carrying hypopi, doors and ventilators should be screened with 20-mesh copper screening. Such small flies as *Sciara* sp. have been observed to carry as many as 50 hypopi each. Fumigating to kill the flies after they have entered is not satisfactory, as the dead flies fall to the beds where the concentration is not strong enough to destroy the hypopi on them. Labourers working around

the mushroom houses are also frequent carriers of hypopi. A liberal sprinkling of paradichlorobenzene crystals through clothing kept in a tight chest kills the hypopi.

C. gracilipes is most likely to be troublesome on autumn or summer crops. Beds filled during frost are unlikely to become infested from outside sources because flies and other insects are inactive.

HOCKENYOS (G. L.). **The Relation of Entomologists to the Exterminating Business.**—*J. econ. Ent.* **28** no. 2 pp. 468–469. Geneva, N.Y., April 1935.

The author points out that it is necessary to establish a definite working relationship between professional entomologists and commercial firms engaged in the destruction of insect pests.

EDDY (C. O.). **A new Spreader for Nicotine.**—*J. econ. Ent.* **28** no. 2 pp. 469–472, 1 ref. Geneva, N.Y., April 1935.

Experiments in Kentucky with combinations of pine tar oil and soap or soap-nicotine solutions [*R.A.E.*, A **22** 404] and further experiments suggested by their results have led to the discovery of two alternative formulae for a spreader (called "Spreader 385" or "Taroleate Spreader") for nicotine sprays. The formulae are: (1) water 5 per cent., potassium hydroxide (92 per cent. flakes) 7·4, pine tar oil (specific gravity 1·035) 44·3, ethylene glycol mono-ethyl ether 10, and oleic acid 33·3; or (2) water 5 per cent., potassium hydroxide 7·4, pine tar oil 48·8, isoamyl alcohol 3, phenol (85 per cent.) 1, ethylene glycol mono-ethyl ether 1·5, and oleic acid 33·3. The ingredients were added in the order given. The potassium hydroxide was dissolved in the water before the pine tar oil was added, without the application of heat. If the amount of water should be reduced to 3 per cent., the combination has to be heated to 140°C. after adding the pine tar oil. The proportions of the solvents have to be modified according to differences in samples of pine tar oil and oleic acid. A small amount of a fine dark precipitate resulted with both formulae. It was filtered out without any change in the results. The precipitate was reduced when materials such as creosote acids, pine tar acids, xylene, sulphonated castor oil and glycerine were used, and was eliminated when resin was substituted for a small but equal portion of pine tar oil and oleic acid. The second formula allows for an increase of pine tar oil and a decrease of solvents, is therefore cheaper and mixes more readily with water, but it is more complex. This spreader contains about twice the amount of active ingredients and was four times as effective, quantity for quantity, as commercial liquid potassium soap spreaders for nicotine in tests against *Aphis rumicis*, L., on nasturtium. The toxicity of nicotine to Aphids was greater with the new spreader than with soluble tar oil containing 10 per cent. potassium oleate. This spreader has been tested for two years at rates varying from 1 to 2 pts. per 100 gals. in the control of Aphids, Jassids and thrips on peaches, apples, grapes, and vegetable crops. The results show that a minimum dosage of 1 pint spreader to 100 gals. is adequate for such surfaces as nasturtium leaves infested with Aphids. The cheapness of the ingredients and the small quantities required make this spreader not more than half as expensive as liquid potassium soap spreaders.

Jones (R. M.). **The Toxicity of Carbon Dioxide - Methyl Formate Mixtures to the Confused Flour Beetle** (*Tribolium confusum* **Duv.**). —*J. econ. Ent.* **28** no. 2 pp. 475–485, 3 graphs, 33 refs. Geneva, N.Y., April 1935.

A review of the literature on its use against insect pests of various types of stored products suggests that in general carbon dioxide alone is not effective as a fumigant except when used for long periods of time or in excessively high concentrations. The experiments here described show that it can be made more toxic to *Tribolium confusum*, Duv., by the addition of small quantities of methyl formate. The following is taken from the author's summary: Data are given on the toxicity of atmospheres containing 50, 75 and 100 per cent. CO_2 alone or with methyl formate. When it was added at the rate of 5 mgm. per litre to the various percentages of CO_2 all the beetles were killed in 4, 6 and 8 hours respectively with 100, 75 and 50 per cent. CO_2, as compared with 10, 20 and 44 hours for the same percentages of CO_2 alone. When methyl formate was added at the rate of 10 mgm. to the litre to the atmospheres containing 50 per cent. CO_2 the beetles were killed in 4 hours. Additional data are included on the toxicity of 50 per cent. CO_2 with the addition of 10 mgm. methyl formate to the egg and larval stages of *T. confusum*. All the larvae were killed by an exposure of 3 hours, whereas 6 hours were required to effect a complete kill of the eggs.

Shotwell (R. L.). **Method for making a Grasshopper Survey.**—*J. econ. Ent.* **28** no. 2 pp. 486–491. Geneva, N.Y., April 1935.

The known egg-laying habits of a few of the most injurious grasshoppers in the Great Plains region of the United States are briefly summarised in view of the importance of such data in making surveys of the occurrence of the species concerned.

The following is the author's summary: A method of making a grasshopper survey is described whereby the extent of an infestation is reduced to a mathematical basis, so that it can be used for determining in advance the amount of materials and the cost necessary for control in a county or State. Grasshopper populations are usually classified as "normal," "light," "moderate," "heavy" and "very heavy." By giving to these categories ratings from 1 to 5, and rating each stop made in the course of the survey according to the degree of infestation found there, on the basis of the number of grasshoppers found per square yard and of egg pods per square foot, etc., it is possible to compute the percentage of infestation for that stop and the average percentage of crop acreage involved for the entire county. By taking this percentage of the total grasshopper-susceptible crop acreage of that county, taken from some crop statistics, the acreage to be poisoned is obtained. The amount of poisoned bait required is computed at the rate of 10 lb. (dry weight) per acre, and the cost figured from the prevailing prices.

Fulton (R. A.) & Bergen (H. G.). **An improved Model of an automatic Insect Flight Trap designed to prevent the Destruction of collected Insects by Water.**—*J. econ. Ent.* **28** no. 2 pp. 491–493, 2 figs., 1 ref. Geneva, N.Y., April 1935.

An apparatus for diverting water to the ground has been devised to fit an automatic insect flight trap, a description of which has

already been noticed [*R.A.E.*, A **19** 550]. A funnel soldered into the main tube of the trap concentrates the drops, and lets them fall into a $\frac{3}{4}$ inch. copper tube, which leads them out of the trap. A 20-mesh copper wire screen fixed over the upper end of this tube is inclined at an angle of 20°, so that the insects falling on it will drop from it into the collecting jar. When temperatures are just above freezing, the copper tubing, being a good conductor of heat, serves to melt snow and sleet as it falls on the screen. This apparatus is particularly good for use on traps in places where they cannot be frequently visited.

ABBOTT (W. S.) & BILLINGS (S. C.). **Further Work showing that Paradichlorobenzene, Naphthalene, and Cedar Oils are ineffective as Repellents against Clothes Moths.**—*J. econ. Ent.* **28** no. 2 pp. 493–495, 6 refs. Geneva, N.Y., April 1935.

In view of Herrick's criticism [*R.A.E.*, A **23** 39] of papers by Bottimer and Billings [**17** 556; **22** 405], who found that paradichlorobenzene, naphthalene and cedar oils do not repel adults and larvae of *Tineola biselliella*, Humm., additional tests were carried out under conditions similar to those that may exist in practical control work. Five tightly constructed boxes were used. In the first was placed a machine from which cedar-wood oil dripped into a porous wood container, and so volatilised constantly into the air, the second had a similar machine containing cedar-leaf oil, in the third was placed 2·5 oz. paradichlorobenzene, and in the fourth 2·5 oz. naphthalene. The fifth was untreated. Two pieces of uninfested woollen goods were placed on the floor of each box. After 24 hours the fumes had thoroughly permeated the boxes, and during the following 10 days 88 clothes moths were liberated in the room. In a second test the positions of the boxes were changed and naphthalene and paradichlorobenzene were suspended in muslin bags near the tops of two of the boxes. During the following 3 weeks 59 moths were liberated in the room. In both experiments the moths went into the treated containers as freely as into the untreated and deposited eggs that hatched, and the larvae remained and fed in all the boxes, showing that the chemicals used are of no value as clothes moth repellents.

The Food and Drug Administration of the U.S. Department of Agriculture issued notices to manufacturers of moth repellents in December 1931 and September 1934 that paradichlorobenzene and naphthalene, respectively, are ineffective as repellents against adults and larvae of clothes moths, and that the sale of these products under representations that they will repel moths is a violation of the Federal Insecticide Act.

MARCOVITCH (S.). **Does Laundering impair the Efficiency of Mothproofing with Sodium Fluosilicate?**—*J. econ. Ent.* **28** no. 2 pp. 495–496, Geneva, N.Y., April 1935.

A piece of mohair was mothproofed by dipping it in a saturated solution of sodium fluosilicate. When dry it was cut into three pieces. One was dry-cleaned and another washed with soap and water. On 4th October carpet beetle larvae were placed on all 3 pieces and on an untreated piece. By 11th November all were dead on the uncleaned and dry-cleaned treated pieces, whereas some survived until 3rd

December on the washed piece. Those on the untreated piece remained alive. Thus, though sodium fluosilicate is soluble in water, the washing merely retarded its action. This would have been less affected in the case of clothes moth larvae, as they succumb much more readily than those of carpet beetles.

KNOWLTON (G. F.) & SMITH (C. F.). **Toads in the Control of Auto-Camp Insects.**—*J. econ. Ent.* **28** no. 2 p. 496. Geneva, N.Y., April 1935.

Records are given of the numbers and orders or families of insects found in the stomach contents of several examples of *Bufo woodhousei*, *B. cognatus* and *Scaphiopus hammondi* in Utah.

ALLEN (T. C.). **Applications of atomized Oil Sprays to certain Truck Crop Insects.**—*J. econ. Ent.* **28** no. 2 p. 496. Geneva, N.Y., April 1935.

Tests carried out in 1933 and 1934 in Wisconsin showed that atomised phytonomic oil sprays [*cf. R.A.E.*, A **21** 473, etc.] were very effective in controlling certain insects infesting vegetable crops. Undiluted sprays containing steeped derris root, naphthalene or oil extracts of pyrethrum compared favourably with aqueous sprays in the control of the onion thrips [*Thrips tabaci*, Lind.]. Oil containing 1·1 mg. pyrethrins I and II per cc., applied at the rate of 3–4 U.S. gals. per acre, was very efficient in controlling the potato leafhopper [*Empoasca fabae*, Harr.]. The yield of potatoes was 42 per cent. more than that of similar plants treated with Bordeaux dust. The foliage was not injured by the oil.

The oil used was a completely refined light hydrocarbon distillate having a 30–35 viscosity and an unsulphonatable residue above 97. It was applied by a two-stage compressor unit driven by a 3 h.p. air-cooled petrol engine. A 3-row boom with 9 nozzles in all was assembled for spraying potatoes, and the weight of the entire outfit was not more than 250 lb., so that it could be mounted on a light conveyer for field use. A hood and canvas drag helped to keep the mist concentrated round the plants.

SALMAN (K. A.). **The Effects of Attack by *Pissodes terminalis* Hopping on Lodgepole Pine in California.**—*J. econ. Ent.* **28** no. 2 pp. 496–497. Geneva, N.Y., April 1935.

Pissodes terminalis, Hopping, which has only once been mentioned in the literature since it was described [*R.A.E.*, A **8** 438], has recently been discovered causing injury to immature lodgepole pines [*Pinus contorta*] in the Sierra Nevadas from the Yosemite Valley, California, north into Oregon. The injury is relatively unimportant in many of the areas where the insect is found, particularly in uneven aged stands where mature trees shade the natural reproduction, but serious damage sometimes occurs in even aged stands of reproduction and pole-wood from 6 ft. to 25 ft. in height, particularly when the individual trees are widely spaced. The adults lay eggs in the terminals, usually in the current season's growth above the last whorl of branches. Oviposition probably occurs in late June and early July. Tips of branches are sometimes attacked, particularly if they are codominant. Several larvae develop within the pith of the terminal, and pupate there in small cells. The infested part withers and dies.

Injury to young trees varies from the occasional loss of the terminal growth of the year of attack to the formation of bushy, misshapen, multiple-boled trees as a result of successive attacks on primary and secondary terminals. In heavily infested areas successive attacks on individual trees are common, causing abnormal forms that change the character of the stand. Mature trees at the margins of the younger stands showed the effect of previous attacks in all three areas of heavy infestation, and the fact that many mature trees have a bushy form and several codominant boles indicates that injury caused by the weevils when the trees are young may account for deformities prevalent in certain mature stands of *P. contorta* in California.

Current Notes.—*J. econ. Ent.* **28** no. 2 p. 500. Geneva, N.Y., April 1935.

Adults and living larvae of *Scolytus intricatus*, Ratz., were found under the bark of split ash poles used in crates for china imported from England into Canada. The crates would have been broken up and used for fencing. This Scolytid attacks elm and other deciduous trees and might serve as a vector of Dutch elm disease [*Ceratostomella ulmi*].

Dean (R. W.). **Preoviposition Period of the Apple Maggot Fly** *Rhagoletis pomonella* **Walsh, in eastern New York.**—*J. econ. Ent.* **28** no. 2 p. 504. Geneva, N.Y., April 1935.

To determine approximately the length of the pre-oviposition period in *Rhagoletis pomonella*, Walsh, under natural conditions, flies removed daily from emergence cages were kept at low temperatures until they became inactive and were then marked with different colours according to age. Daily liberations were than made over a period of 15 days in unsprayed apple trees. Data obtained from laboratory dissections of females subsequently recovered, by collection in vials or on sheets placed beneath trees during the application of a dust of nicotine and lime, indicated that the average pre-oviposition period under normal conditions in the Hudson Valley, is 9–10 days, with a probable minimum of 7–8 days.

Speyer (E. R.). **Entomological Investigations.**—*Rep. exp. Res. Sta. Cheshunt* **20** (1934) pp. 70–78. Cheshunt, Herts., 1935.

The breeding of *Comedo opaculus*, Thoms., for the control of the tomato moth [*Polia oleracea*, L.] in England was discontinued, as it appeared to be ill-adapted to its host for various reasons [*cf. R.A.E.*, A **22** 481], including its failure to reproduce parthenogenetically, its habit of frequently depositing all its eggs on one larva and its apparent need for a second host during the pupal period of *Polia* in summer. The larvicidal efficiency of lead arsenate, cryolite and cuprous cyanide was compared by spraying potted tomato plants. Lead arsenate and cryolite were used at the rate of 6 lb. per 100 gals., and cuprous cyanide at 6, 3, and 1½ lb. With lead arsenate and cuprous cyanide, saponin was used as a spreader. Since these substances are distasteful to the larvae, death may result from starvation under experimental conditions, whereas in the field food may usually be obtained from untreated parts of the stem and fruit or from weeds that may occur in the glass-house. The results appear to show that cryolite was an efficient poison and

rendered the foliage less repellent than did lead arsenate or cuprous cyanide, that too heavy a deposit of cuprous cyanide deters the larvae from feeding at all, and that the action of this compound when used at 3 lb. is similar to that of lead arsenate. A finer type of cuprous cyanide used at this rate appeared to give good results in two tests. Twenty adults of *Stethorus punctillum*, Wse., the larvae and adults of which feed on the red spider mite [*Tetranychus telarius*, L.], were received from Belgium in May. Oviposition began and numerous larvae were observed on hydrangeas during June, and by the end of the month the Coccinellid was found on roses in a greenhouse about 150 yards away from the breeding house. Unsuccessful attempts were made to induce it to feed on the mite on tomato, bean and carnation during July, and it disappeared during the summer. It probably thrives only in shady places, since it is only known to effect some control in vineries [*cf.* **23** 290].

A dust of nicotine, naphthalene and magnesium hydrate [**22** 481] was used successfully against *Thrips nigropilosus*, Uzel, which injured chrysanthemum cuttings and has not apparently been previously recorded in glasshouses in England, *Scirtothrips longipennis*, Bagn., which damaged cyclamen flowers in a nursery in October and *Thrips tabaci*, Lind., which attacked cucumber and melon. It was less satisfactory against *T. fuscipennis*, Hal., than a pyrethrum dust, applications of which should be started by the beginning of March in nurseries where the thrips appears in spring. Investigations indicated that stunting of nursery tomatos combined with a blue appearance of the foliage and marks of gnawing round the collars of the plants was more probably due to the woodlouse, *Armadillium vulgare*, Latr., than to *Scutigerella immaculata*, Newp. Watering groups of plants in 6 in. pots with 5 fl. oz. of solutions of mercury bichloride, at dilutions of 1 in 3,000 and 1 in 4,000, killed all the Symphilids in 4 and 5 days, respectively. They were killed or made to leave the soil by excessive watering. *Onychiurus armatus*, Tull., injured the foliage of lettuce growing under glass in November 1933 and February 1934, but was easily controlled by sprinkling small amounts of naphthalene on the surface of the soil near the plants. Leaves touching the soil and in severe cases the younger foliage also are first pitted and then partly skeletonised.

In experiments, when baits of cuprous cyanide and bran or dried blood were freshly made and kept quite dry, the cuprous cyanide proved an efficient poison for woodlice, but when they were used on a commercial scale, the compound decomposed and lost its efficiency. Injury to young chrysanthemums standing out of doors was due to leafhoppers, Capsids and Aphids derived from numerous weeds in the vicinity. Control was obtained by a few applications of a nicotine wash at intervals of 4 days.

Borg (P.). **Report of the Plant Pathologist.**—*Rep. Dep. Agric. Malta 1933–34* pp. 3, 43–46. Malta, 1935.

Aphelinus mali, Hald., introduced from Italy into Malta and Gozo during 1933–34 has already greatly reduced the numbers of *Eriosoma lanigerum*, Hsm., which is distributed throughout practically all apple orchards. Coccids, particularly *Chrysomphalus dictyospermi*, Morg., were numerous on *Citrus* and other plants ; the abundance of *Icerya purchasi*, Mask., was attributed to the severity of the preceding winter,

which weakened and killed colonies of *Rodolia* (*Novius*) *cardinalis*, Muls. [*cf. R.A.E.*, A **21** 585]. Fresh colonies were liberated. The application of soap solution (1 : 32) every 15 days during June–October prevented much of the injury to fruits by the fruit-fly [*Ceratitis capitata*, Wied.]. In small scale experiments heavy dusts of sulphur gave equally good results. *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.) is becoming more and more injurious to vegetables on irrigated lands kept continuously under cultivation for several successive years. Treatment of the plots with powdered naphthalene is a successful and the most popular control measure, but probably the cheapest method is the substitution of wheat for vegetables every third year. The outbreak of *Scolytus rugulosus*, Ratz., on stone-fruit trees in Gozo [*loc. cit.*] has increased. *Cerambyx miles*, L., annually destroys large numbers of apple and pear trees.

Roepke (W. K. J.). **Kort verslag op het iepenziekteonderzoek verricht aan het Laboratorium voor Entomologie der Landbouwhoogeschool gedurende het jaar 1934.** [A brief Report on the Elm Disease Investigation at the Entomological Laboratory of the Agricultural High School in 1934.]—*Tijdschr. PlZiekt.* **41** no. 5 pp. 121–124. Wageningen, May 1935.

In investigations made by J. J. Fransen in Holland on Dutch elm disease, caused by *Ceratostomella* (*Graphium*) [*ulmi*], and on the Scolytids (*Scolytus scolytus*, F., and *S. multistriatus*, Marsh.) associated with it, it was found that trunks infested by the latter require to be submerged for at least a year, while uninfested trunks submerged for six months are not likely to become infested [*cf. R.A.E.*, A **22** 339]. No success attended experiments in poisoning the bark to kill beetles boring into it, or in killing larvae in the bark by insecticide washes. The Scolytids did not appear to prefer varieties of elm resistant or almost resistant to *Ceratostomella*. They attacked young elms sprayed with lead arsenate or Paris green more readily than unsprayed trees, but the sprayed trees were less infected with *Ceratostomella*, the insecticides having possibly acted as fungicides. Trapping gave encouraging results, the best being obtained with elm trunks bearing bands of adhesive.

The mite, *Pseudotarsonemoides innumerabilis*, Vitzt., was found to promote fructification of the fungus in the pupal chamber. The Braconid, *Coeloides scolyticida*, Wesm. [*loc. cit.*], appeared to have established itself in a district into which it had been introduced.

Hylesinus (*Pteleobius*) *vittatus*, F., which also infested elms, was found to have only one generation a year, and to hibernate in the adult stage. Its possible importance as a vector of *Ceratostomella* requires investigation.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION (LEXINGTON, Ky.) :
Bulletin Nos. 21 (1889), 31 (1890), 47 (1893), 53 (1894), 71 (1898) and 91 (1901).

THE KENYA AND EAST AFRICAN MEDICAL JOURNAL (NAIROBI) : Vol. II, Nos. 2–3 (1925).

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